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THE PSYCHOLOGY
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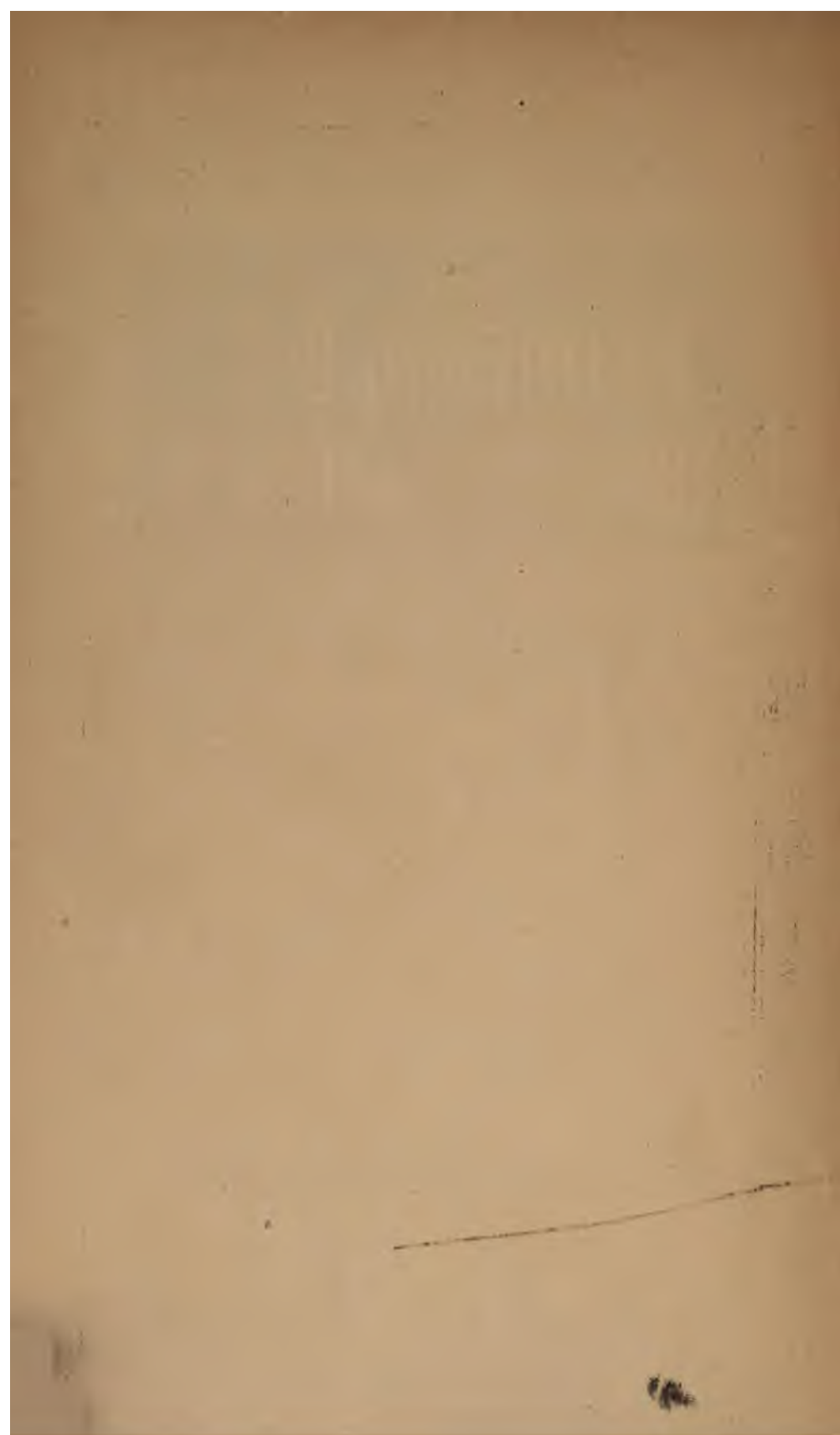
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THE
PSYCHOLOGY OF ATTENTION.

By TH. RIBOT,

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CHAPTER I.

INTRODUCTION.

MUCH study has been given to the effects of attention, very little to its mechanism. The latter point alone I propose to consider in this work. Even within these limits the question is important, for, as will be seen later, it is the counterpart, the necessary complement of the theory of association. Should this essay contribute never so little to make plain this *lacuna* in contemporary psychology and to induce others to fill it, its end will have been attained.

Without attempting for the moment to define or characterize attention, I shall suppose that every one understands sufficiently what the term denotes. A greater difficulty is to know where attention begins and where it ends, for it comprises all the degrees between the fleeting instant given to a fly that buzzes at one's ear and the state of complete absorption. It will be in conformity

with the rules of correct method if we shall study only plain, typical cases, that is, those which present one, at least, of these two characters—intensity and duration. When the two coincide the attention is at the maximum. Duration standing alone attains the same result: as for example, when by the light of several electric sparks one makes out a word or a figure. Intensity standing alone is equally effective: thus, a woman at a mere glance sees a rival's entire costume. Attention in its fainter forms cannot teach us anything; at all events it would not do to begin our study with them. Until we have traced the main outlines, it is idle to note nice distinctions or to lose time in considering subtleties.

The purpose of this work is to establish and to justify the following propositions:

There are two clearly distinct forms of attention, one spontaneous, the other voluntary, artificial.

The first, disregarded by most

psychologists, is the true, primitive, fundamental form of attention. The second, which alone is studied by the majority of psychologists, is but an imitation, a result of education, of training, and of habit. Unsteady and vacillating by nature, it derives all its substance from spontaneous attention and in it alone finds its support. It is but an improved instrument and a product of civilization.

Attention, under its two forms, is no indeterminate activity, no "pure act" of the mind acting in ways mysterious and incomprehensible. Its mechanism is essentially a *motor* mechanism, that is, it acts always upon muscles and through muscles, chiefly in the form of an inhibition; and we might take for the motto of this study that phrase of Maudsley's: "He who is incapable of controlling his muscles is incapable of attention."

Attention under both its forms is an exceptional, abnormal state, which cannot endure for any length of time, because it contradicts the fundamental condition of psychic life—change. Attention is a fixed state. If it be prolonged unduly, especially under unfavorable conditions, then, as every one knows, there is produced a progressive clouding of the mind, and finally a sort of intellectual void often accompanied by vertigo. These slight and passing disorders indicate the radical antagonism between attention and normal psychic life. The approximation toward unity of the consciousness which is the very ground of attention, is seen more clearly still in the distinctly pathological cases which we will consider later, in their chronic form—fixed ideas—and in their acute form—ecstasy.

For the present, still keeping to general considerations, we can, by the help of this very definite character—the tendency to unity of consciousness—reach a definition of attention. Take an adult man, in good health and possessing average intelligence: the ordinary mechan-

ism of his mental life consists in an unceasing come-and-go of inward occurrences—a train of ideas and sensations coalescent or repellent according to certain laws. Properly speaking, this is not, as it is often said to be, a chain, a series, but rather an irradiation in several directions and at different levels: an unstable aggregate that is ever forming, breaking up, and forming again as everyone knows: this mechanism has been very thoroughly studied in our time, and the theory of the association of ideas is one of the points best ascertained in contemporary psychology. Not that everything has been done, for, in our opinion, sufficient account has not been taken of the part played by the *affective* states as a hidden cause of a great many associations. Oftentimes one thought will call forth another, not because of any resemblance between them so far forth as they are representations, but because one same affective fact enwraps them and unites them.* Then, too, we have yet to reduce the laws of association to the laws of physiology, and the psychological mechanism to the cerebral mechanism, which underlies it: but we are still far distant from that ideal.

The normal state is plurality of states of consciousness, or, to use the term employed by some authors, "polyideism." Attention is a momentary stopping of this ceaseless thronging, in favor of one state of consciousness: this is "monoideism." But it is essential to define clearly the sense in which we use this term. Is attention a reduction to one single state of consciousness? No; internal observation teaches that it is only a *relative* monoideism; in other words, that it supposes the existence of a mastering idea which attracts whatever relates to itself and nothing else, allowing associations to form only within very narrow bounds, and only so far as they converge to one

*See examples in James Sully, "Illusions" chapter vii (Humboldt Library, Nos. 56 and 57).

same point. It diverts to its own advantage, at least as far as it can, the whole activity of the brain.

Do there exist cases of *absolute* monodeism, in which consciousness is reduced to one single state wherein the mechanism of association is totally arrested? In our opinion, this does occur in certain very rare cases of ecstasy which we will analyze later; but it lasts only for an instant, because consciousness, being placed outside of the conditions that are strictly necessary for its existence, vanishes.

Attention, then—and again be it remarked that we are considering only clearly-defined cases—attention consists in the substitution of a relative unity of consciousness for a plurality of states of consciousness—for change, which is the rule. Nevertheless this does not suffice for a definition of attention. A violent toothache, a nephretic colic, an intense enjoyment produce a momentary unity of consciousness which we do not confound with attention. Attention has an object; it is not a purely subjective modification: it is a cognition, an intellectual state. Here is another character to be noted.

This is not all. To distinguish it from certain states which approximate to it, and which will be considered in the course of this work—fixed ideas, for example—we must take account of the adaptation which always accompanies it, and which, as we shall endeavor to prove, in great part constitutes it. Wherein consists this adaptation? For the moment let us content ourselves with an entirely superficial view.

In cases of spontaneous attention the whole body converges—the eyes, the ears, sometimes the arms—toward its object; all movements are stayed. The personality is held fast, that is to say, all the individual's tendencies, all his disposable energy are directed upon the same point. The physical, external adaptation is the sign of the psychic, internal adaptation. The convergence is the reduction to unity,

substituted in the place of the diffusion of movements and attitudes which characterizes the normal state.

In cases of voluntary attention the adaptation is more commonly incomplete, intermittent, precarious. The movements are arrested, but reappear from time to time. The organism converges, but in a lax and nerveless fashion. The intermittences in the bodily adaptation betoken the intermittences in the mental adaptation. The personality is held fast only partially and momentarily.

I beg the reader to excuse whatever in these remarks is obscure or insufficient. Details and proofs will come later. I have simply designed to prepare the way for a definition, which may be stated in these terms: attention is an intellectual monodeism with adaptation whether spontaneous or artificial of the individual. Or if another formula be preferred, attention consists of an intellectual state, exclusive or predominant, with spontaneous or artificial adaptation of the individual.

And now we quit these general considerations to study the mechanism of all the different forms of attention.

CHAPTER II.

SPONTANEOUS ATTENTION.

SPONTANEOUS attention is the only form of attention that exists save where education and artificial agencies have done their work; no other is seen in most animals and in young children. It is a gift of nature very unequally distributed. But whether strong or weak *its cause is affective states*. Their rule is absolute, and has no exception.

Man, as animal, spontaneously bestows his attention only on that which touches himself, which interests him, which produces in him a state whether agreeable, disagreeable, or mixed. Since pleasure and pain are but signs that certain of our tenden-

cies are gratified or countered; since our tendencies constitute that which is inmost of us; and since they express what is deepest in our personality, our character, it follows that spontaneous attention has its roots in the very foundation of our being. The nature of the spontaneous attention in a person reveals his character, or at the least his fundamental tendencies. It tells us whether the man is a frivolous, commonplace, narrow-minded person, or broad and deep. The portress spontaneously gives her whole attention to gossip; the painter, to a fine sunset, in which the rustic sees only the coming on of night; the geologist, to the stones he sees in his walks, which for the uninitiated have no interest at all. Let the reader look within or around: examples are as easy to find as it is needless to dwell upon them.

That a truth so evident, one confronting us everywhere—indeed spontaneous attention without a prior affective state would be an effect without a cause—that this should not long ago have been a *locus communis* in psychology, might well surprise us, had not most psychologists been set in the determination to study only the higher forms of attention, that is, to begin at the end.* Now, it is important that we study the primitive form: without it nothing is understood, nothing explained, all is confusion, and we are without a clue in this study. Hence we shall not hesitate to multiply proofs.

A man or animal incapable *ex hypothesi* of experiencing pleasure or pain, would be incapable of attention. For him there could be only states more intense than other states—a very different thing. Hence we may not hold, in the same sense as Condillac, that if amid a multitude

of sensations one predominates by its liveliness, it is “transformed into attention.” It is not intensity alone that acts, but, above all, our adaptation, that is, our tendencies, countered or gratified. Intensity is only one element, often the least. And observe how natural spontaneous attention is, how it requires no effort. The loungeur sauntering in the street stands open-mouthed while a procession passes, imperturbable while the spectacle lasts. If at any moment there is an appearance of effort, that betokens that the attention changes its nature—that it becomes voluntary, artificial.

In the lives of great men are found many facts which prove that spontaneous attention depends wholly on the affective states. These facts are the best for our purposes as exhibiting the phenomenon in all its force. Great power of attention is always caused and sustained by great passions. Fourier, says Arago, was wayward and incapable of application till his 13th year; then he was initiated in the elements of mathematics, and became another man. Malebranche took up by chance and with repugnance Descartes's treatise “On Man:” the reading of it “caused him palpitations of the heart so violent that every hour he had to lay down the book and to break off the reading of it so that he might breathe at ease,” and he became a Cartesian. “But,” it will perhaps be said, “these facts simply betoken a vocation manifesting itself.” Yes, but what is a vocation but an attention which finds its way and which decides what course it will take through life? Indeed no finer examples of spontaneous attention are to be found, for this endures, not for a few minutes or for an hour, but always.

Let us consider another side of the question. Is the state of attention continuous? Yes, apparently; in reality it is intermittent. “What is called attending to an object is, strictly speaking, following a series

*So few are the psychologists who have clearly perceived the importance of affective states in attention that the only names I can cite are Maudsley, “Physiology of Mind,” chap. V.; Lewes, “Problems of Life and Mind,” vol. III. p. 184; Carpenter, “Mental Physiology,” chap. III.; Norwicz “Psychologische Analysen,” vol. I.; and a few disciples of Herbart, in particular Volkmar, “Lehrbuch der Psychologie,” vol. II., p. 114.

of connected impressions or thoughts with an ever renewed interest. For instance, when one attends a dramatic show. . . . Even when there is question of a small material object—a coin or a flower—there is a continual passing of the mind from one aspect to another, a series of suggestions. Hence it would be more exact to say that the object is a center of attention, the point from which it starts and to which it is continually returning.*

Certain psycho-physical researches of which we shall speak later (Chap. III) show that attention is subject to the law of rhythm. Mr. J. Stanley Hall, who has carefully studied the subject of gradual changes of pressure produced on the finger tips, finds that the perception of continuity seems impossible—that we cannot have a perception of continuous increase or continuous decrease. Attention chooses among many degrees of pressure to compare them. Certain errors in registering astronomic phenomena are also due to these oscillations of attention.†

Maudsley and Lewes compare attention to reflex action: more properly it might be compared to a series of reflex actions. A physical excitation produces a movement. In like manner, a stimulation coming from the object produces an ever-repeated adaptation. Spontaneous attention, when it is deep and tenacious, possesses all the characters of a passion that is never stilled and which is ever striving to attain its object. The dipsomaniac never sees a glass of liquor but he drinks it, and were some maleficent sprite to fill it as often as it was emptied, he would never cease to drink. The erotic passion acts in the same way. Vicq d'Azyl held that monkeys are not educable because they cannot be made attentive—a false assumption, by the way. Gall made answer: Show to a monkey a female monkey

and you will see that he is capable of attention. The mind of a Newton acts in like manner when a scientific problem occurs to him: it is a constant irritant ever spurring him on, never leaving him in quiet. No fact is clearer, more incontestable, more easily verified than this: spontaneous attention depends on affective states—desires, gratifications, dissatisfaction, jealousy, etc.; its intensity and duration depend on the intensity and duration of these.

Note here an important fact in the mechanism of attention. This real intermittence in apparent continuity alone makes protracted attention possible. If we keep one eye fixed upon one point, after a while vision becomes indistinct, a cloud forms between the object and us, at last we see nothing. If we lay our hand prone upon a table, without bearing upon it (for pressure is a movement), little by little the sensation grows fainter and finally disappears. The reason is that there is no perception without motion, however faint that may be. All sensorial organs are at once sensitive and motor. When absolute immobility removes one of the two elements—motility—the function of the other is soon done away. In short, motion is the condition of change, and change is one of the conditions of consciousness. These familiar, every-day facts show us the necessity of these intermittences in attention often imperceptible to consciousness because they are so very brief and very minute.

The physical manifestations of attention are many and of great importance. We will examine them minutely, premising that we consider them less as the effects of this state of the mind than as its necessary conditions—often even as its constituent elements. This study, far from being secondary, is for us of prime importance. To obtain anything like a clear notion of the mechanism of attention, our investigation must be made here. Strictly it is simply an

* Sully "Outlines of Psychology," Chap. IV.

† "American Journal of Psychology," 1887; "Philosophische Studien," 1888.

attitude of the mind, a purely formal state: strip it of all the physical accompaniments which determine it, which give it a body, and there is left a pure abstraction, a phantasm. Hence those who have treated of attention only from the standpoint of interior observation, have been dumb as to its mechanism and have contented themselves with lauding its potency.

We must ever keep in mind this fundamental principle: Every intellectual state is accompanied by determinate physical manifestations. Thought is not, as many still hold by tradition, an event that takes place in a supra-sensuous, ethereal, inapprehensible world. To repeat the dictum of Setchekoff: "No thought without expression;" that is, thought is a word or an act in the nascent state—a beginning of muscular activity. The sensorial forms of attention testify so plainly to this principle that it is not to be questioned: and the same is to be said of that inward and hidden form, of which we will speak later, called Reflection.

The physical concomitants of attention may be classed in three groups; vaso-motor phenomena, respiratory phenomena, and motor or expressional phenomena. These all denote a state of convergence of the organism, and of concentration of work.

I. "Suppose 20 persons fix their attention for 5 to 10 minutes on their little finger. What will happen will be about this. Some of them will have *no* consciousness of any sensation; others will have marked sensations—suffering, pain, arterial pulsations; most of them will feel a faint impression of weight and as of ants creeping. This simple experiment brings up the following questions: Are there not always in sundry parts of the body sensations due to the incessant modifications of the tissues—modifications that pass unnoticed unless attention is fixed upon them? Can the act of attention increase the

vascular activity of the sensorial ganglia and produce subjective sensations? Finally, can the sympathetic centers be excited, can the vaso-motor nerves be so influenced as to call forth transient vascular modifications in the finger to which the sensation is referred? The first supposition seems to be only very faintly probable. In fact one may always feel a sensation in the finger when one attentively seeks that sensation. We think the other two suppositions are well grounded. Perhaps the sensation felt is partially subjective; but in our opinion the finger upon which thought is fixed for a sufficient time is really the seat of a sensation. The vascular modifications that ensue are felt in the form of arterial pulsations, weight, etc."*

It is highly probable and almost universally admitted that attention, even when it does not apply to any region of our body, is accompanied by local hyperæmia of certain parts of the brain. The vascularization of the parts concerned increases by reason of a greater functional activity. This local hyperæmia has for its cause a dilatation of the arteries, and the cause of this dilatation itself is the action of the vaso-motor nerves upon the muscular coats of the arteries. The vaso-motor nerves depend upon the great sympathetic, which is exempt from the action of the will, but which is subject to all the influences of the affective states. Mosso's experiments show that the most fleeting emotion causes an afflux of blood to the brain. "The circulation of the blood is more active in the cerebral organ while it works than during rest. Hence we are justified in saying that attention in directing itself upon a group of ideas produces an accelerated circulation in the nervous *substratum* of those ideas. Precisely this takes place when an idea takes strong hold of the mind: it keeps up an active circulation in the brain and allows

*Hack Tuke, "Mind and Body." Chapt. 1.

it neither rest nor sleep.* Note, too, the flushing (sometimes the paleness) of the face after prolonged attention.

II. The respiratory modifications which accompany attention resemble the motor phenomena proper and have a part in producing the sense of effort. The rhythm of the respiration changes; it is slowed, and sometimes undergoes a temporary stoppage.

The yawning which follows a prolonged effort of attention is probably the effect of the slowing of the respiration, often, in such cases, we draw a long breath so as fully to renew the air in the lungs. The sigh, another respiratory symptom, is, as sundry authors have remarked, common to attention, and to pain whether physical or moral: its end is to oxygenize the blood that is narcotized by the voluntary or involuntary arrest of respiration.

These facts are so many proofs of what has already been said, namely, that attention is an exceptional, abnormal fact which cannot last long.

III. The bodily movements which, as the phrase goes, express attention, are of the highest importance. In this chapter we can make only a partial study of them; the remainder will find its place under the head of Voluntary Attention (Chapt. III *infra*.); here for the first time we propose to have a glimpse of the motor mechanism of attention.

First we will consider the facts. These have never till our day been seriously studied. Formerly artists, and a few physiognomists too devoted to their fancies, alone took any interest in the matter.

Duchenne, of Boulogne, in this as in many other fields a pioneer, be-thought him to substitute the experimental method in place of pure observation as practiced by his predecessors, Charles Bell, Gratiolet, and others. He produced by electricity isolated contraction of a facial muscle in a man suffering anæsthesia

and had the result photographed. According to the theory set forth in his "*Mécanisme de la Physionomie Humaine*" (1862), often contraction of one muscle suffices to express an emotion; each affective state produces one local modification. Thus, according to him, the frontal muscle is the muscle of attention, the superior orbital of the eyelids is the muscle of reflection, the pyramidal the muscle of threatening, the great zygomatic the muscle of laughter, the superciliar the muscle of pain, the triangular of the lips the muscle of contempt, and so on. But Duchenne limited himself to establishing the facts, therein following the example of Johannes Müller, who declared the expression of emotions to be a fact wholly inexplicable. Darwin went further. Applying the comparative method and resting upon laborious researches, he investigated the origin of the different mechanisms of expression; he sought to explain why contraction of a given facial muscle is necessarily associated with a certain determinate state of the mind.

While these minute observations were lacking, any attempt to explain the mechanism of attention would have been premature. How, indeed, explain a mechanism the parts of which you know nothing about? Let us see what is known about attention in its two forms—applied to external objects (attention proper), or applied to interior occurrences (reflection).

Attention (for clearness' sake we will qualify it as *sensorial*) contracts the frontal muscle. This muscle occupies the whole frontal region: it has its movable insertion in the skin of the eyebrow, and its fixed insertion in the posterior part of the cranium. In contracting, it draws to itself the eyebrow, lifts it, and produces transverse wrinkles on the forehead: in consequence, the eye opens wide and is well lighted. In extreme cases the mouth opens wide. In children and in many grown persons keen attention causes protrusion

* Maudsley, "Psychology of the Mind."

of the lips—a sort of pouting. Preyer has sought to explain this play of physiognomy by an hereditary influence. “All animals” he says, “direct their attention first to the search for food. The objects that may be reached by their lips, their feelers, their proboscis, and their tongue, are the ones they first examine. Thus, all search for food is accompanied by a preponderant activity of the mouth and its belongings. In the sucking young the mouth is elongated.” And so we see an association between the first movements of the mouth and the activity of attention.

Reflection expresses itself in another manner, nearly the reverse of this. It acts upon the superior orbicular muscle of the eyelid, and pulls the eyebrow down. In consequence there are formed small vertical folds in the inter-superciliar space, the eye is veiled by the lid, or entirely closed, or it looks within. This wrinkling between the eyebrows gives to the physiognomy an expression of intellectual energy. The mouth is shut, as if to sustain an effort.

Attention adapts itself to what is without, reflection to what is within. Darwin explains by an analogy the way that reflection expresses itself; it is, he says, the attitude of difficult vision, transferred from external objects to internal happenings which cannot easily be made out.*

So far we have spoken only of movements of the face, but there remain those of the whole body—the head, the trunk, the limbs. It is impossible to describe them in detail, for they are different in different species of animals.† In general they consist of immobility, adaptation of the eyes, the ears, the touch, according to the circumstances: in short a ten-

dency to unity of action, convergence. Concentration of the consciousness and concentration of the movements, diffusion of thoughts and diffusion of movements, go in couples. Consult the observations and calculations of Galton upon the subject. He studied the behavior of an audience of fifty persons listening to a dull lecture. The number of clearly discernible movements in the audience was very uniform, being 45 a minute, or on the average, one movement per head. Several times, the attention of the people having been awakened, the number of movements grew smaller; besides, they were less ample, less prolonged, shorter and more rapid.

In passing I anticipate an objection. As all know, attention, at least in its reflected form, is sometimes accompanied by movements. Many persons find that walking helps them out of a perplexity; others strike their forehead, scratch their head, rub their eyes, or keep moving arms or legs in a certain rhythm. This is an outlay, not an economy of motion; but it is an outlay that brings advantage. The movements so produced are not mere mechanic phenomena acting on the world without—they act also, through the muscular sense, upon the brain, which receives them as it receives all other sensorial impressions, and they augment the brain's activity. A rapid walk, a ride on horseback, quicken the flow of thoughts, and of speech; as Bain says, they produce a mechanic intoxication. The experimental researches of Mr. Féré, which we cannot reproduce here,* supply numerous instances of the force-producing action of movements. We stretch our arms and legs to make ready for work, that is we awaken the motor centers. Passive movements given to paralyzed limbs have in some cases, by reviving former motor impressions, brought back lost power of action. And be it

*For details see Darwin, “Expression of the Emotions,” Chapt. X; Preyer, “The Mind of the Child;” Mantegazza, “La Physiologie,” Chapt. XVI.

†A good study of expression and attention in animals is found in Riccardi, “Saggio di Studi e di Osservazioni intorno all'Attenzione nell' Uomo e negli Animali. Modena,” 1887.

*See his work, “Sensation et Mouvement.”

noted that these movements augment the mental activity instead of concentrating the attention; they simply furnish matter to it. It is a preliminary operation.

This objection put aside, we have next to determine the true rôle of movements in attention. So far we have simply been describing them—at least the principal ones. Let us state the question in the clearest and simplest terms:

The movements of the face, the body, the limbs, and the respiratory modifications which accompany attention, are these, as usually supposed, merely effects, signs? Or are they, on the contrary, *the necessary conditions, the constituent elements, the indispensable factors of attention?* The second proposition we maintain unhesitatingly. Totally suppress the movements, and you totally suppress attention.

Though just now we cannot establish this proposition save in part—the study of voluntary attention, which is reserved for another chapter, will exhibit it to us under a new aspect—nevertheless, since we here touch an essential point in the mechanism of attention, it is well to look at it for a while.

The fundamental rôle of movements in attention consists in *sustaining* the state of consciousness and in *reinforcing* it. As this is a question of mechanism, it is best to look at its physiological side, and to inquire what goes on in the brain considered both as an intellectual organ and as a motor organ.

1. As an intellectual organ, the brain serves as a *substratum* to the sense-perceptions (in sensorial attention), and to images and ideas (in reflection). *Ex hypothesi*, the nerve-elements in active function-furnish work superior to the average. Attention certainly causes an intense innervation, as is proved by the many psychometric experiments in which it plays a part. "An idea in activity," says Maudsley, "produces in the nervous elements a

molecular change which is propagated along the sensitive nerves to the periphery or at least to the sensorial ganglia, the sensibility of which is thus increased. From this propagation of molecular action to the ganglia it results that the muscles relating to the sense affected become by reflex action in some degree tense and augment the feeling of attention. In Hartmann's opinion, attention "consists in material nerve-vibrations," in "a nerve-current traversing the sensitive nerves, directed from the center to the periphery." But there is another element, nor is it the least important.

2. As a motor organ, the brain plays a complex rôle. First, it starts the movements that accompany the sense-perception, image, or idea; then these movements, often intense, return to the brain by way of the muscular sense, as sensations of movement; these augment the quantity of available energy, which on the one hand serves to support or to reinforce the consciousness, and on the other hand goes back to its starting-point as a new movement. Thus there is a going and coming between the center and the periphery, in both directions, and from the one to the other back again, and so on. The intensity of the consciousness is but the subjective expression of this complex work. But it were a gratuitous hypothesis in flat contradiction to the teaching of experience, to suppose that the intensity of the state of consciousness can persist without these organic conditions. The simple-minded spectator who grows tired at the opera because he cannot understand the music at all, is all attention when a sudden change of the scenes occurs; that is, when the visual impression brings about an instantaneous adaptation of the eyes and of the whole body. Without this organic convergence, the impression would vanish speedily. "In the preponderant reaction on the sensitive parts, the original source of the *processus*," says Wundt, "con-

sists essentially the difference between attention and voluntary movement. In the latter, the central excitation takes its main direction toward the muscles; in attention, the muscles do not concur save in subordinate sympathetic movements;*" in other words, a reflection of movements is produced.

If, then, we compare the ordinary state with the state of attention, we find in the first, faint representations and but little movement; in the second, a vivid representation, energetic and convergent movements, and furthermore reverberation of the movements produced. It makes little difference whether the last element be conscious or no.

It will perhaps be said: admitting this reaction of the movements upon the brain, still there is nothing to show that at bottom they are anything but a simple effect of attention. Three hypotheses are possible: attention (state of consciousness) is the cause of the movements; or it is their effect; or it is first the cause, then the effect.

I prefer not to choose between these three hypotheses, which have a value purely logical and dialectic, and to state the question otherwise. Under the above form, it is quite impenetrated—without appearing to be so—with that traditional dualism which it has cost psychology so dear to rid itself of; and it amounts after all to asking whether in attention the soul acts first on the body or the body on the soul. That riddle is not for me to solve. Physiological psychology sees only two internal states, differing from each other by their proper qualities as well as by their physical concomitants. If the intellectual state produced is faint, brief, without recognizable expression, there is no attention. If it is strong, stable, well defined, and translated by the physical modifications mentioned above, there is attention. We maintain that attention does not exist *in abstracto*, as a purely interior

happening: it is a concrete state, a psycho-physiological complex. In our spectator at the opera, do away, *ex hypothesi*, with the adaptation of the eyes, head, body, limbs, the changes in the respiration and the cerebral circulation, and the reaction, conscious or unconscious, of all these phenomena upon the brain; what remains of the original whole, thus despoiled and emptied, is no longer attention. If aught remains, it is an ephemeral state of consciousness, the shadow of what was before. This example, extravagant as it is, will, we hope, make our meaning clearer than would a long discourse. The motor manifestations are neither effect nor causes, but elements: with the state of consciousness which is their subjective side, these *are* attention.

Still the reader is not to take all this as anything more than a rough outline, a provisional view of the subject, which will be completed further on. Thus, we say nothing of the feeling of effort, because it is very rare in spontaneous attention, if perchance it is found there at all; but the rôle of the movements is of such importance that we revert to it again and again.

3. The state of surprise or astonishment is spontaneous attention magnified; a few words about it. Though frequent in daily life, it has been forgotten by psychology. Still I find in Descartes's "Traité des Passions" (Pt. 2, Art. 70) this definition: "Admiration is a sudden surprise of the soul, which leads it to consider with attention objects which to it seem rare and extraordinary. Thus, it is caused, first, by the impression in the brain which represents the object as rare and consequently as worthy of being regarded highly, then, by the movement of the spirits, which are by this impression led to tend with great force toward the place in the brain where it [i. e. the impression] is, there to 'en and sustain it: as also

*"Physiologische Psychologie," p. 723-24, first ed.

they are by it disposed to pass thence into the muscles which serve to keep the organs of the senses in the same situation in which they are, to the end that it may be still maintained by them, if it has been formed by them.' This passage is worth the trouble of being meditated.* If it be read with care, it will be found that, allowance made for difference of language nearly all the elements we have endeavored to point out in the mechanism of spontaneous attention, are here clearly enumerated: the augmentation of the nervous influx in consequence of the impression, its partial diversion toward the muscles, the action of these muscles to "sustain" and "strengthen" it. Note, in passing, that Descartes's procedure is that of physiological psychology, not that of the spiritualist† psychology which wrongfully enough claims descent from him.

Surprise, in a higher degree astonishment, is a shock produced by what is new and unexpected: for example, if a stay-at-home whom I suppose to be in his own town 500 miles away should enter my room.

From the mental side there is little to be said of it. It belongs to the group of Emotions, and in its stronger form it is a commotion. Properly speaking, it is not so much a state as an interval between two states, a brusque rapture, a *lacuna*, an hiatus. At the instant of the shock the prior polyideism stops short,

because the new state bursts in like a giant upon the "struggle for life" between the two states of consciousness. Little by little, the new state is classed, brought into connection with others, equilibrium tends to be reestablished; there has been time for adaptation. The intellectual element resumes the mastery over the emotional. Still it is very probable that, in surprise, feeling is in excess, cognition in defect.

On the physical side, the symptoms are an exaggeration of the spontaneous attention.

"Attention is manifest by a slight elevation of the eyebrows: when it passes into the state of surprise, the eyebrows are raised much more energetically; the eyes and also the mouth open wide. . . . The degree to which both are opened is in proportion to the intensity of the surprise felt.*

This raising of the eyebrows is an instinctive act, for it occurs in those born blind: it causes the eyes to be opened very rapidly. As for the opening of the mouth, that allows of a deep inspiration such as we always take before any great effort.

As we have said, surprise is spontaneous attention magnified. This proposition I think is fully justified. What is best demonstrated is the affective causes of spontaneous attention; for there is an insensible gradation from this to surprise, astonishment, stupefaction, finally to fright and terror, which are affective states of great intensity.

Coming back thus to our starting-point we may now see that the origin of attention is very lowly and that its earliest forms are tied down to the the most imperious conditions of animal life. Attention had at first only a biological value. The habit of psychologists to restrict themselves to voluntary attention and even to its higher manifestations, concealed this origin.

We may declare *a priori* that if attention has for its cause affective

* The passage runs thus in French: "L'admiration est une subite surprise de l'âme, qui fait qu'elle se porte à considérer avec attention les objets qui lui semblent rares et extraordinaires. Ainsi, elle est causée premièrement par l'impression qu'on a dans le cerveau qui représente l'objet comme rare et par conséquent digne d'être fort considéré; puis, ensuite, par le mouvement des esprits qui sont disposés par cette impression à tendre avec une grande force vers l'endroit du cerveau où elle est pour l'y fortifier et conserver: comme aussi ils sont disposés par elle à passer de là dans les muscles qui servent à retenir les organes des sens en la même situation qu'ils sont, afin qu'elle soit encore entretenue par eux, si c'est par eux qu'elle a été formée."

† Here used in the sense of "opposed to materialism." As employed in philosophy, the words, spirit, spiritual, spiritualist, spiritualism, etc., have nothing to do with the belief, or the practice of those who in our day are commonly called spiritualists, but who ought to be called spiritists, and their system practice, spiritism. [Translator.]

* Darwin's "Expression of the Emotions."

states, which themselves have for their cause tendencies, wants, appetites, it is in the last analysis referable to that which lies deepest in the individual—the instinct of self-preservation.

A rapid examination of the facts will enable us better to see that the possibility of being attentive is an advantage of the first order in the struggle for life; but we must quit man and descend lower, very low down in the animal scale. I put aside the strictly rudimentary forms of psychic life, as lending themselves too readily to conjecture. To produce attention, there is need at least of a few developed senses, a few clear perceptions, and a sufficient motor apparatus. Riccardi, in the work already cited, finds in the *Arthropoda* the first clear expression of attention.

An animal so organized that the impressions of the outer world shall be to it all equivalent and shall all in his consciousness stand upon the same plane, no one predominating nor winning for itself an appropriate motor adaptation: such an animal were ill equipped for self-preservation. I set aside the extreme case—where the predominance and adaptation should be in favor of hurtful impressions; for an animal so constituted must needs perish, being an illogical organism, an embodied contradiction. The usual case remains, to wit, predominance of useful sensations, viz., those connected with nutrition, self-defense, propagation of its kind. The impression of prey to be captured, enemies to be avoided, a female to be from time to time impregnated, fixes itself in the consciousness of the animal, accompanied by adapted movements. The attention is at the service of and dependent on the animal's needs; always associated with the sense that is best developed, whether it be touch, sight, hearing, smelling, according to the species. There it is seen in all its simplicity, and there it is most instructive. It was needful to descend

to these rudimentary forms to understand the reason of its power—it is a condition of life,—and it will preserve the same character in the higher forms where, being no longer a factor of adaptation to the physical environment, it will become, as we shall see, a factor of adaptation to the social environment. In all the forms of attention, from lowest to highest, there is *unity of composition*.

Even among the higher animals attention loses its narrow, material character. The vast majority of animal species are confined within this narrow circle: nutrition, self-defense, propagation, sleep, and herein they expend their activity. The more intelligent possess a superabundant activity which they expend in play—a manifestation so important that many authors regard it as the source of art. To this need of luxury corresponds an attention for luxury. The dog whose master amuses it in a certain way becomes attentive when it sees him getting ready; and a good observer of children, Sikorski, has shown that their activity and their attention are developed especially in their sports.*

CHAPTER III.

VOLUNTARY ATTENTION.

VOLUNTARY or artificial attention is a product of art, of education, of imitation, of training. It is grafted on spontaneous or natural attention, and in it finds the conditions of its existence, as the graft does in the trunk into which it is inserted. In spontaneous attention, the object acts by its intrinsic power; in voluntary attention, the subject acts by extrinsic, that is, super-added powers. Here the end is no longer set by chance or circumstances; it is willed, chosen, accepted, or at least submitted to; the question is one of

* "Revue Philosophique," April, 1885.

adapting oneself to it, of finding the fit means of maintaining the attention: hence this state is always accompanied by some feeling of effort. The maximum of spontaneous attention and the maximum of voluntary attention are strictly antithetic, the one proceeding in the direction of the strongest attraction, the other in that of the strongest resistance. They are the two poles, and between them are all the degrees possible, with a point where, in theory at least, the two forms coalesce.

Though voluntary attention is nearly the only form of attention that has been studied by psychologists, and though most of them know of no other, still its mechanism is not better known. In endeavoring to get some notion of it, we propose to inquire, first, how voluntary attention is produced—to investigate its genesis; then we will study the feeling of effort which accompanies it, and finally the phenomena of inhibition which, in our opinion, play a chief part in the mechanism of attention.

I. The process by which voluntary attention is produced is reducible to this one formula: Rendering attractive by artificial means that which is not so by nature; giving an artificial interest to things which have not a natural interest. I use the word "interest" in its vulgar sense as equivalent to the periphrase "what keeps the mind alert." But the mind is kept alert only by an action agreeable, disagreeable, or mixed, of objects upon it, that is, of affective states. But in this case the feelings which keep up the attention are acquired, superadded, not spontaneous as in its primary manifestations. The whole matter is thus reduced to finding effective motives; if these be wanting, there is no voluntary attention.

Such is the process in general terms; in practice it varies *ad infinitum*.

To understand aright the genesis of voluntary attention, the best way

is to study children and the higher animals. The simpler the examples the better.

In the first period of its life, the child is incapable of any but spontaneous attention. It fixes its gaze only on brilliant objects, or on the face of its mother or its nurse. Toward the end of the third month, it explores the field of vision, gradually resting its eyes upon objects less and less interesting (Preyer). It is the same with the other senses; the transition is made little by little from what concerns most to what concerns least. The fixing of the gaze, which later becomes intense attention, is translated outwardly by the more pronounced contraction of sundry muscles. The attention is accompanied by a certain affective state called by Preyer the "emotion of astonishment." In its highest stage, this state produces temporary immobility of the muscles. According to Sikorski, "astonishment, or rather the emotion which accompanies the psychic process of attention, is above all characterized by momentary suspension of respiration—a phenomenon that strikes one especially who is accustomed to the rapid respiration of children."* It is well-nigh impossible to tell at what period the will first makes its appearance. Preyer thinks he has observed it in the fifth month, but under the impulsive form; as a power of inhibition it makes its appearance a good deal later.

While the psychic life remains thus in the tentative stage, attention, i. e., the transference of the mind from one object to another, is determined only by their power of attraction. The birth of voluntary attention, which means the possibility of holding the mind to non-attractive objects, can be brought about only by force, under the influence of education, whether that come from man or from things. That which comes from man is

* "Le Développement Psychique de l'Enfant." (*Revue Philosophique*, Avril, 1886).

easiest to demonstrate, but is not the only education.

A child refuses to read; it is incapable of keeping its mind fixed on letters that have no attraction for it; but it looks eagerly at pictures in a book. "What do these pictures say?" Its father answers: "When you are able to read, the book will tell you." After several talks such as this, the child surrenders, sets about the task at first languidly, then it acquires the habit of study, and finally shows an eagerness that has to be checked. That exhibits the genesis of voluntary attention. On a desire that is natural and direct is grafted a desire artificial and indirect. Reading is an operation that has no direct attraction, but as a means it possesses an attraction—a borrowed attraction—and that suffices: the child has made the first step. Another example: A six-year-old child *habitually very inattentive*, one day of its own accord goes to the piano to repeat an air that pleased its mother; its exercise lasted more than an hour. The same child, at the age of seven, seeing its brother busied with his vocation tasks, went and sat down in its father's library. "What are you doing?" asked its nurse, surprised to find the child there. "I am doing a page of German," was the answer; "it is not very amusing, but it is a nice surprise I mean to give mama"* Here we see another case of voluntary attention, grafted on a sympathetic feeling, not on an egoistic one as in the first example. The piano, the German did not spontaneously call forth attention: they awaken and sustain it by a borrowed force.

Universally, at the beginning of voluntary attention, we find this mechanism ever the same, with innumerable variations, resulting in success, half-success, or failure: it is ever taking up natural motives, diverting them from their direct end, and using them, if possible, as means to another end. Art bends nature

to its purposes, and hence I call this form of attention *artificial*.

Without pretending to enumerate the different motives artifice sets at work to call up and to confirm voluntary attention, that is, to give to the end to be attained a power of action that it does not possess naturally, I note in the formation of voluntary attention three chronological periods.

In the first, the educator can act only upon the simple feelings: he employs fear in all its forms, egoistic tendencies, the attraction of rewards, the tender and sympathetic emotions, the innate curiosity that is as it were the appetite of the intelligence and which is found in all in one degree or another.

In the second period, artificial attention is awakened and sustained by feelings of secondary formation: self-love, emulation, ambition, interest (in the sense of advantage), duty, etc.

The third period is that of organization: attention is awakened and sustained by habit. The schoolboy in his class-room the artisan in his shop, the clerk in his office, the shop-keeper behind his counter, all would generally prefer to be elsewhere; but self-love, ambition, interest, have by repetition produced a lasting habitude. The acquired attention is become second nature; art has its perfect work. The one fact of being placed in a certain posture, amid certain surroundings, decides all the rest; attention is produced and sustained not so much by present causes as by prior ones; habitual motives have taken the place of natural motives. Those who withstand education and discipline never reach the third period: in them voluntary attention is produced rarely, intermittently, and cannot become a habit.

It is not necessary to show in detail that in animals the transition from spontaneous to voluntary attention takes place in like manner under the influence of education, of training; but the trainer has at his disposal only restricted means of action,

* B. Perez, "L'Enfant de 3 à 7 Ans," p. 108.

simple in their nature. He acts through fear, privation of food, violence, kindness, caresses, and so at last causes the animal to form habits, by artifices makes it attentive. As among human beings, so among animals some are educable, others refractory. "A man," says Darwin;* "who trains monkeys to act in plays, used to purchase common kinds from the zoological society, at the price of £5 for each; but he offered to give double the price, if he might keep three or four of them for a few days in order to select one. When asked how he could possibly learn so soon whether a particular monkey would turn out a good actor, he answered that it all depended on their power of attention. If, when he was talking and explaining anything to a monkey its attention was easily distracted, as by a fly on the wall, or other trifling object, the case was hopeless. If he tried by punishment to make an inattentive monkey act, it turned sulky. On the other hand, a monkey which carefully attended to him could always be trained.

Thus then, we find at the root of attention nothing but affective states, attractive or repulsive tendencies. In the spontaneous form there are no other causes but these. It is the same with the voluntary; but here the feelings are of a more complex nature, of slow formation, drawn by experience from the primary tendencies, while voluntary attention is still in its genetic period, before it is organized, fixed by habit, if you take from the schoolboy self-love, emulation, fear of punishment; if you make the shopkeeper and the artisan rich; if you give to the clerk a competence in the early days of his career: all their attention toward distasteful work vanishes, for there is no longer aught to call it forth or maintain it. This account of attention is, I confess, very complex, but it is conformable to facts. If we are to believe most of the psychologists,

voluntary attention—the only form that counts for anything with them, though it is only a derivative, an acquired form—comes into being fully equipped. "It is subject to the superior authority of the Ego. I yield it or I withhold it as I please; I direct it in turn to several points; I concentrate it upon each point as long as my will can stand the effort"* if that is not a conventional and fanciful description; if the author derives it from his own experience, I cannot but admire it. But in truth one must needs be bereft of all power of observation and blinded by foregone conclusions, not to see that voluntary attention, in its stable form, is a state difficult to maintain, and that many a one fails to reach that bourne.

But if as we have endeavored to show, the higher form of attention is the work of the education we have received from our parents, our instructors, from our environment, and of the education we have acquired ourselves, the explanation merely places the difficulty farther back; for our educators have merely acted upon us as others had acted upon them, and so on for generations. Hence we have here no explanation of the primordial genesis of voluntary attention.

How then did it arise? Out of necessity, under the pressure of need, with the progress of intelligence. *It is a perfected instrument and a product of civilization.* The same progress by which, in the moral order, the individual has passed from the reign of instinct into that of interest or of duty; in the social order, from primitive savagery into the state of organization; in the political order, from almost absolute individualism into constituted government: by that same progress man has, in the intellectual order, passed from the reign of spontaneous attention to that of voluntary attention. The latter is both cause and effect of civilization.

* "Descent of Man," § 116 (No 74, Humboldt Library)

* "Dictionnaire Philosophique."

In the preceding chapter it was remarked that in the state of nature, both for animal and for man the possibility of spontaneous attention is a factor of prime importance in the struggle for life. So soon, as, for whatever causes—lack of game, density of population, a poor soil, more warlike neighbors, etc.—a horde must needs either die out or adapt itself to more complex life-conditions—that is, go to work—voluntary attention also becomes a prime factor in this new form of the struggle for life. When man became capable of applying himself to a task having no direct attraction but accepted as a means of livelihood, then voluntary attention made its appearance in the world. Hence it arose under the pressure of necessity and of the education which we get from our surroundings.

It can easily be shown that before civilization voluntary attention was not or appeared only by flashes, without duration. The laziness of savages is notorious; travelers and ethnologists are agreed upon this point, and so abundant are the proofs and instances that it is useless to cite them. The savage loves the chase, war, gaming—chance, the unknown, the unforeseen in every form; but continuous work he knows not, or despises. The love of work is a sentiment of secondary origin that goes with civilization. Now work is the concrete form of attention. Continuous labor is repulsive even to half-civilized tribes. Darwin asked of some Gauchos whom he found given up to drink, gaming, and theft, why they did not work. One of them answered: "The days are too long." "The life of the primitive man," says Herbert Spencer,* "is passed mainly in the pursuit of beasts, birds, and fish, which yields him a gratifying excitement; but though to the civilized man the chase gives gratification, this is neither so persistent nor so general

. . . Conversely, the power of continued application, which in the primitive man is very small, has among ourselves become considerable. It is true that most are coerced into industry by necessity, but there are sprinkled throughout society men to whom active occupation is a need—men who are restless when away from business and miserable when they eventually give it up; men to whom this or that line of investigation is so attractive that they devote themselves to it day after day, year after year hardly giving themselves the rest necessary for health."

Since in order to live even after the manner of savages, disagreeable work has sometimes to be done, such work, as we know, falls upon the women, who, while the man sleeps, labor for fear of being beaten. Hence it is possible, though at first it seems a paradox, that voluntary attention first began with the woman.

Even in nations for ages civilized there exists a large number of creatures incapable of continued labor—the vagabonds, professional thieves, prostitutes. The new Italian school of criminal statisticians discern in this fact, rightly or wrongly, cases of atavism. The great majority of civilized people have adapted themselves sufficiently to the exigencies of social life: they are in some degree capable of voluntary attention. But small indeed is the number of those of whom Spencer speaks—for whom it is a necessity; few are they who profess and practice the maxim *stantem oportet mori*. Voluntary attention is the sociological phenomenon. When we consider it as such, we understand its genesis and its feebleness.

It has now, we think, been shown that voluntary attention is an adaptation to the conditions of a higher social life, that it is a discipline and a habit, an imitation of natural attention, which is its starting-point and its basis.

*"Data of Ethics," Chapt. X (Humboldt Library No. 9.)

2. So far we have been considering in the mechanism of attention only the external pressure of motive forces and of the environment which transfer it from one form to the other. We now come upon a much more difficult question, namely, the study of the inner mechanism whereby a state of consciousness is laboriously maintained, in spite of the psychological struggle for life which ever tends to do it away. The relative monoidism which consists in a preponderance of a certain number of internal states adapted to one end to the exclusion of all others, does not need to be explained in the case of spontaneous attention. A state, or group of states, predominates in the consciousness because it is by far the stronger; and it is by far the stronger because, as we have seen, all the tendencies of the individual conspire to favor it. In the case of voluntary attention, particularly in its more artificial forms, the contrary holds. By what mechanism, then, is this state sustained?

We need not inquire how the state of voluntary attention is produced in daily life. It comes into existence, like any other state of consciousness, at the bidding of circumstances; but that which distinguishes it from them is that it is maintained. If a schoolboy having little liking for mathematics recollects that he has a problem to work out, that is simply a state of consciousness; if he goes to work and persists, that is a state of voluntary attention. In this possibility of holding the attention, of inhibition, is found the entire problem.

How can we produce an inhibition? Here we enter upon a question well known in physiology, almost unexplored in psychology. That we have the power, in many cases, of arresting [inhibiting] the movements of sundry parts of our body, is proved by constant experience. But how is the equivalent of this inhibition produced in the mental order? Were the physiological mechanism of in-

hibition better known, the answer might perhaps be less obscure.

The fundamental property of the nervous system is that it transforms a prime excitation into a movement. That is reflex action, the type of nerve activity. But we know further that some excitations may prevent, or slacken, or suppress a movement. The most familiar instance, the one earliest investigated, is the suspension of the heart movements by irritation of the pneumogastric. Since the discovery of this, due to the brothers Weber in 1845, physiologists have with great ardor studied cases where excitation of a nerve prevents a movement or a secretion. Pflüger showed that the splanchnic nerve has an inhibitory action upon the small intestine. It was later shown that the movements of the stomach and of the whole intestinal tube are subject to inhibition. Claude Bernard refers to the same cause the action of the vaso-dilator nerves. Finally, this power of inhibition belongs not only to the spinal chord and the bulb, for it exists in the brain. Setschenof was the first to hold that the middle brain (optic thalami) has an inhibitory influence upon the inferior portions of the cerebro-spinal axis. Many authors in recent times have referred the phenomena of hypnotism to a cortical inhibition. And according to Brown-Séquard, "inhibition is a power possessed by nearly every portion of the central nervous system and by a considerable portion of the peripheric nervous system."

To explain this "negative reflexion" many different theories have been proposed, but we need not describe them.* Still it is to be noted that Ferrier, in his "Functions of the Brain," first called attention to an action of the moderating centers, which he places in the frontal lobes. According to Ferrier, the recalling

*For the history of the question down to 1879, see Hermann, "Handbuch der Physiologie," vol. II., pt 2, p. 33 *et seqq.* For the more recent theories, see, S. Lourie, "I Fatti e le Teorie della Inibizione." Milano, 1888.

of a thought depends upon the excitation of the motor element that enters into its composition; attention depends upon restriction of movement: there is repression of diffusion abroad and increase of diffusion within. Excitation of the motor centers, protected against diffusion abroad, expends its force inwardly; there is repressed excitation of a motor center. For localizing these moderating centers in the frontal lobes his principal reasons are these: Intelligence is proportioned to the development of attention; it is also proportioned to the development of the frontal lobes. Irritation of these lobes does not produce any motor manifestation, hence they are moderating agencies, and expend their energy in producing changes in the centers of actual motor execution. Removal of them does not cause any motor paralysis, but a mental degenerescence which results in a loss of the power of attention. The frontal lobes are imperfectly developed in idiots, whose power of attention is very small. The frontal regions become weaker and weaker in animals as the grade of intelligence grows lower. We may add that lesions of the frontal lobes greatly lessen and often quite destroy the power of control.* The author further declares that "as to the physiological basis of this faculty of control, only theoretical views can be put forward."

Though the theory that the phenomena of inhibition take place in special organs has become almost classical, many recent authors, on the ground of their experiments, have held that "motor action and inhibition have their seat in the same elements."† "Whenever we excite a

nerve," says Beaunis, "there are produced in that nerve two kinds of modifications in opposite directions. Be it a motor nerve: in that nerve there will be a putting in action that will be expressed by a tremor of the muscle; but besides this phenomenon, which is the one most easily seen and best studied, there is also produced an opposite state which will tend to efface the tremor, or to prevent its coming."* The motor process appears sooner than the process of inhibition and lasts for a shorter time. A first excitation causes a maximum tremor; but at the second excitation the inhibitory action which tends to come on, diminishes the amplitude. In one of Wundt's experiments, "When a nerve is excited by a constant current, there is produced in the anode an inhibiting wave, recognized by a diminution of excitability in the nerve, and which is propagated slowly from the two sides of the anode: at the same time there is produced at the cathode a wave of excitation which is propagated from both sides of the cathode with a greater velocity and intensity. An excited nerve is thus pervaded at one time both by a wave of inhibition and by a wave of excitation, and its excitability is only the algebraic resultant of these two opposite actions."

On this hypothesis, then, every excitation produces in the nerve substance two modifications, one positive, the other negative—a tendency on the one hand to activity, on the other a tendency to inhibition of this activity; the ultimate result is simply the resultant of these opposite actions, so that now impulsion, anon inhibition predominates.

We have set forth very summarily nearly all that physiology teaches us with regard to the mechanism of inhibition, and we shall have occasion to profit by it. Let us go back to the psychological study.

*Op. cit., p. 97.

* Compare the work "Diseases of the will" (Humboldt Library No. 52). Quite recently an American neurologist, Alex. Starr, in 23 cases of lesion of the frontal lobes, found in one-half of the patients the following mental trouble, viz.: loss of the faculty of control, change of character, impossibility of fixing attention. "Brain," January, 1886, page 570.

† Wundt, "Untersuchungen zur Mechanik der Nerven und Nervencentren," 1871, 1876, and "Psychologie Physiologie," vol. I., chapt. vi.; Beaunis, "Recherches Expérimentales sur les Conditions de l'Activité Cérébrale et sur la Physiologie du Nerf," Paris, 1884. Beaunis more than any other physi-

ologist dwells upon the importance of inhibitory actions for psychology.

The power of voluntary inhibition, whatever its *modus operandi*, is a secondary formation; it appears relatively late, as do all manifestations of a high order. Volition in its positive, impulsive form, the volition which *does*, comes first in chronological order. Volition in the negative form, which *prevents*, appears later—according to Preyer, toward the tenth month, under the lowly form of inhibition of the natural evacuations.

But how do we produce an inhibition? No satisfactory answer can be made. Nevertheless it is to be remarked that here our position is precisely the same as with regard to the opposite question—How do we produce a movement? In positive volition the “I will” is commonly followed by a movement; that is, there is first a putting in action, in the brain, of motor images or appropriate motor *residua*, a transmission of the nervous influx through the *radio medullaris cerebri* to the *corpora striata*, the lower stratum of the cerebral peduncle, to the bulb, then, after decussation, to the spinal cord, to the nerves, finally to the muscles.

In negative volition the “I will” is usually followed by an inhibition: the anatomical and physiological conditions are less known; on the hypothesis given above they are hardly different from those of the preceding case. But in both cases consciousness knows directly only two things: the departure and the arrival, the “I will” and the act produced or inhibited. All the intermediate states escape it, and it knows them only of acquired knowledge and indirectly. Such being the sum of our actual knowledge, we must content ourselves with declaring as a fact that, just as we have the power of beginning, continuing, and increasing a movement, so we have the power of suppressing, interrupting, and diminishing a movement.

These general considerations lead us to one positive result at least, to wit, that an act of volition, whether

impulsive or inhibitive, *acts only upon muscles and through muscles*; that consequently if the mechanism of attention is motor, as we maintain, then in all cases of attention there is a play of muscular elements, of movements whether actual or in the nascent state, upon which the power of inhibition acts. We have no power of action (whether impulsive or inhibitive) save upon the voluntary muscles; that is our sole positive conception of will. Of two things then one has to be chosen: either to find muscular elements in all manifestations of voluntary attention, or to give up all explanation of its mechanism and to restrict ourselves to saying what it is.

Attention applies itself voluntarily to sense-perceptions, images, or ideas; or, to speak more precisely and without metaphor, the state of *monoideism* may be sustained voluntarily by a group of sense-perceptions, images, or ideas adapted in advance to an end. We have to determine the motor elements found in these three cases.

1. As regards sense-perceptions no difficulty exists. All our organs of perception are both sensorial and motor. To perceive with our eyes, ears, hands, feet, tongue, nostrils, there must be movement. The more motility in any organ, the more exquisite is its sensibility; the less the motility, the more obtuse the sensibility. Nor is this all: without motor elements perception is impossible. As we have already said, if one keeps his eyes fixed upon an object, soon his vision becomes confused, and then fails him. Apply the tips of the fingers to a table without pressure, and in a few minutes the contact is no longer perceived. A movement of the eyes, or of the fingers, however slight, reawakens perception. Consciousness is not possible except through change; change is not possible save through movement. We might discourse at length on this subject, for though the facts are perfectly evident and of

everyday experience, psychology has so disregarded the rôle of movements that at last it forgot that they are a fundamental condition of knowing, being the instrument of the fundamental law of consciousness, which is relativity, change. Enough has been said to justify this absolute formula: No movement, no attention.

The rôle of movement in sensorial attention admits of no doubt. The watchmaker who studies minutely the works of a watch, adapts his eyes, hands, body: all other movements are suppressed. In laboratory experiments for studying voluntary attention, this state of concentration by inhibition of movements attains at times an extraordinary height. Of this we will speak later. The reader may recall the observations of Galton stated in the preceding chapter, upon the movements produced in a tired audience. Attention therefore means concentration and inhibition of movements. Distraction means diffusion of movements.

Voluntary attention may also act upon the expression of emotions, if we have strong reasons for not giving outward expression to a feeling, and a power of inhibition sufficient to prevent it; but it acts only on the muscles and on the muscles alone; all else escapes it.

So far we have considered the question from its easier side. We come now to that purely internal form known as *reflection*. This has for its subject matter images or ideas. Thus we have to find in these two groups of psychic states motor elements.

2. "It does not at first view seem evident," wrote Bain as early as 1855, "that the retention of an image in the mind is the work of the voluntary muscles. What are the movements produced when I represent a circle, or when I think of St. Paul's? An answer cannot be made to this question save by supposing the mental image to occupy in the brain and the rest of the nervous system the same place as in the original sensa-

tion. As there is a muscular element in our sensations, particularly in those of the higher order, as touch and hearing, that element must in one way or another find its place in ideal sensation, in recollection." Since 1855, the question of the nature of images has been studied closely and with good results, and has been solved in the same sense.* For most of the old school psychologists, the image was a sort of phantasm without fixed seat, existing in the soul, differing from sense-perception not in degree but in nature, resembling it "at most as a portrait resembles its original;" but for the physiological psychology there is between sense-perception and image identity of nature, identity of seat, and difference only of degree. The image is no photograph, but a revival of the sensorial and motor elements that constituted the perception. As its intensity increases, the image approximates more and more to its starting-point, and tends to become an hallucination.

If we restrict ourselves to the motor elements of images (and these alone interest us here) it is plain that since there is no perception without movement, the latter leaves in the brain motor residua (motor images, motor intuitions), just as impressions on the retina or on the skin leave sensorial impressions. Had the motor apparatus no memory, images, or residua, no movement could be learned and made habitual: all would have continually to be learned anew. There is no need of reasoning to prove this. Experience is ever teaching that movement is inherent in the image and contained therein. The celebrated experiment of Chevreul with a pendulum may be regarded as the type of this sort of facts. Is there need of any more? People throw

* Consult Taine, "On Intelligence," Book II.; Galton, "Inquiry into Human Faculty," pp. 83-114; Charcot, "Leçons sur les Maladies du Système Nerveux," vol. III.; Binet, "Psychologie du Raisonnement," chapt. II.; Ballet, "Le Langage Intérieur et les Diverses Formes de l'Aphasie."

themselves into gulfs through fear of falling into them, cut their throats with razors through fear of cutting their throats; people are "mind-readers" because they are able to "read" muscular states; and the explanation of it all is the elementary psychological fact that *every image contains an element of movement*. True, the motor element has not always these enormous proportions, but it exists at least in the nascent state; just as the sensorial image has not always the vividness of hallucination, but is simply outlined in the consciousness.

3. It is easy to prove the existence of motor elements in images; the question of general ideas or concepts is more difficult. It is to be remembered that physiological psychology has given very little study to ideology, and that this needs to be studied anew from the standpoint of the date of actual experience. For this task the study of sense-perception and images has prepared the way. I have no intention to treat here episodically so broad a question. I simply propose, by way of showing the bearings, to distribute general ideas in three great categories, viz.:

Those which result from the fusion of *like* images, without the aid of words;

Those which result from the fusion of *unlike* images, with the aid of words;

Those which are reducible to a word, accompanied by a vague *schema*, or even without any concomitant representation.

I do not take into account the regulator concepts [*concepts régulateurs*], namely time, space, cause, the study of which would carry us too far. Let us see if each of these three categories contains motor elements upon which attention can act.

a. The first category comprises the general ideas of space in the rudest sense, those found in the higher animals, infants, and deaf-mutes before the use of analytic

language. The operation of the mind is limited to seizing very striking resemblances and so forming *generic images*—a term more precise than "general ideas." This operation seems closely analogous to the process by which Galton, by superposing several photographs obtains the composite portrait of a family, that is, accumulation of resemblances and elimination of slight differences: but to maintain, as many have done, that this process explains the formation of general ideas is to defend an untenable thesis; it explains only the lowest grade of these, since it can deal only with strong resemblances. Now do these generic images comprise a motor element? It is very difficult to say, and in any case it is useless, for it is not at this stage of mental life that voluntary reflection appears.

b. The second category comprises the greater number of the general ideas that serve for the current uses of thought. In a complete study of the subject we should have occasion to establish an ascending coördination of groups rising from the less to the more general, in other words, exhibiting the power of discerning resemblances fainter and fainter, analogies less and less numerous. All the steps of this ascent are seen in the history of mankind. The Fuegians have no abstract terms. The American Indians have terms to denote the white oak and the black oak; but they have no word for oak in general. The Tasmanians have a term for each species of trees, none for tree in general; *a fortiori*, none for plant, animal, color, etc.* Not to dwell upon these different phases, what have we in mind when we think these general ideas? First, a word, which is the fixed element: with it, an image less and less complex, less and less clear, in proportion as we rise in generalization. This image is an "extract." It is formed by a process which the mind employs even to represent to

*Lubbock, "The Origin of Civilization," chap. IX; Tylor, "Primitive Culture," vol. 1., Chap. VII.

itself an *individual* image. In fact, a representation of Peter, of Paul, of my dog, of any concrete thing fully known by me, is simply an extract from multiplied perceptions that I have had, and which have given me this under different aspects. In the representation of an individual image there is a struggle between the prior images of the object as to which shall have the ascendant in the consciousness. In the conception of a general idea there is a struggle between divers generic images as to which shall prevail. It is an "extract" of the second or third degree. Thus is formed a nucleus around which oscillate elements vague and obscure. My general conception of man or dog, if it persist for ever so short a time in consciousness, tends to assume a concrete form: it becomes à white man or a negro, a spaniel or a bulldog. The motor element is represented mainly by the word—to that we will return. As for the images, or extracts of images attached to the word, it were difficult to tell what in them remains of the movements included in the original sense-perceptions.

c. In the preceding category, in proportion as the ideas become more general the rôle of the images becomes less and less conspicuous, and the word more and more preponderant, till at last it stands alone. Thus we have this progressive series: generic images without words, generic images with words, words without images. In the last stage we find purely scientific concepts. Does the word exist alone in the mind at this supreme period of abstraction? I unhesitatingly adopt the affirmative. I cannot enter into details, which would carry me beyond my subject; I content myself with observing that if actually there is not anything under the word, there is, there must be a potential knowledge, the possibility of a cognition "In actual thought," says Leibnitz, "we are wont to omit explanation of the signs, knowing or

believing that we have this explanation at command; but this application or explication we do not judge to be actually necessary This method of reasoning I call blind, or symbolic. We employ it in algebra, in arithmetic, in fact universally." The acquiring of numeration by children, better still by savages, shows how the word, at first attached to objects, next to their images, by degrees becomes detached from these and stands independent. Finally, it is like fiduciary money (bank notes, bank checks, etc.), presenting a like utility, and like dangers. Here the motor element cannot be found save in the word. The recent researches referred to above, have shown that the word does not exist in all individuals in the same form. For some it consists mainly in articulatory states. Stricker, in his work "*La Parole et la Musique*," describes, from his own experience a perfect type of this. For others it consists mainly in auditive images: this is *internal speech* well described by V. Egger. Others, much fewer, think by the aid of words read or *written*.*

These persons are "visuals." Among the majority of men all these elements act in unequal proportions. But universally the word that is uttered in a loud voice, the sign purely internal, rests upon some form of original sense-perception and consequently comprises motor elements.

That the motor elements included in general ideas of all these categories are often very faint is not to be doubted. And this accords with the fact of common experience that abstract reflection is for many persons impossible and for nearly all persons difficult and fatiguing.

We have dwelt long upon this portion of our subject because it is the least investigated, the most difficult, the most exposed to criticism.†

*A curious instance of this is published in the "*Revue Philosophique*" for Jan. 1885, page 119. See also Ballet, *opus citatum*, Chapt. III.

†The study of a large number of normal or of morbid cases, we have said, has led to the knowledge of several types: motor, auditive, visual, according to the group of images dominant in each

But some reader will say, "We admit that there are motor elements in sense-perceptions, images, and, in less degree, in concepts. But that does not prove that attention acts upon these and by these, that it is a motor mechanism." True, there is no decisive observation or experiment to be cited upon this point. The crucial experiment would consist in seeing whether a man deprived of all external and internal

individual, to say nothing of the ordinary or indifferent type. The one who thinks words by articulating them without hearing them (Stricker), he who thinks words by hearing them without articulating them (V. Egger), and he who thinks words by seeing them written, without hearing them or articulating them, represent irreducible types. That cuts all discussion short. Each is right in what concerns himself and his like; he is wrong if he generalizes without restriction.

It is to be wished that the work done with regard to images and the different forms of language were done also for general ideas. It is probable that there also we should find irreducible types. Thus, Berkeley to me seems to think general ideas under the visual form. Whoever will read attentively certain passages (too long to quote) of the famous Introduction to his "Treatise on Human Nature," who shall study them not as a theory of general ideas, but as psychological evidence, as a psychological confession, will conclude that for Berkeley the general idea was a vision.

"The idea of man," he says, "that I can form for myself must be the idea of a white man or a black man, a man straight or bent, big or little or of middle size. I cannot by any effort of thought conceive of the abstract idea described above"—i. e. of a color neither red, nor blue, nor green, etc., and yet is a color. On the other hand, to me the Nominalists seem to think general ideas under the purely auditive form. The famous theory which makes universals mere *status vocis* (Roscelin, Hobbes, et alii) appears to me to be susceptible of two interpretations. Taken literally it is nonsense. The pure *status vocis* is a word of a language one knows nothing whatever about, a word not associated with any idea, and which consequently is just a sound, a noise. It is hardly probable, that sane thinkers would have maintained the thesis in the form usually credited to them. I offer another interpretation. The Nominalists are unimaginative, algebraic minds [*des esprits secs, algébriques*] for whom the word is enough, without summoning up any image; in them there is no other representation but that of the sound. From this to Berkeley is a long way.

Stricker, who is a pure "motor," who cannot think a word without articulating it, and who is as little an auditive as man can be, says: "I must needs attach something (*sic*) to every word so that it may not appear to me as a dead term, as a term in a language unknown to me. Whenever there occur to my mind words such as 'immortality' or 'virtue' I explain them usually to myself not by words but by visual images. At the word 'virtue,' for instance, I think of some female form; at the word 'bravery' I think of a man armed," and so on. (*Opus citatum*, p. 80, 81). This conception of abstract and general ideas may be regarded as the opposite of Nominalism. In medicine it is said that there are no diseases, only diseased persons; so there are no general ideas, only minds that think in different ways. Instead of proceeding philosophically, i. e., seeking to reduce all to unity, it were time to proceed psychologically, i. e. determining the principal types. If that were done many a dispute would come to an end of its own accord.

motility, and of that only, would still be capable of attention. But no such experiment, is possible. Nothing at all like it is found in the morbid cases that we shall consider later. Still, it may be remarked that it is impossible to reflect when one is running at full speed, even if one runs merely for running's sake. A multitude of instances show that there is antagonism between a large expenditure of movement and the state of attention. It is true that people exercise attention while walking rapidly and gesticulating; but here we have a work of invention rather than of concentration, and the surplus nerve-force is expended in different ways. In short, it is evident that attention is an inhibition, and this inhibition cannot be produced save by a physiological mechanism which prevents the expenditure of real movements in the sensorial attention, and of movements in the nascent state in reflection; for the movement produced is a restitution to without, a vanishing of the state of consciousness, the nerve force which produces it being transformed into a motor impulsion. "Thought," says Setchenof, "is a reflex action reduced to its first two thirds;" or as Bain expresses it more elegantly, "Thought is a refraining from speaking or doing."

To conclude, let us see what is to be understood by the current expression, "voluntarily to direct one's attention to an object." and consider what then takes place, "What takes place then," says Maudsley, "is simple excitation of certain nervous currents of ideation and maintaining them in activity till they shall have brought into the consciousness by the irradiation of their energy all the associated ideas, or at least as many ideas as can be put in action in the momentary state of the brain . . . It hence appears that the force which we call attention is rather a *vis a fronte* than a *vis a tergo*— . . Consciousness is the re-

sult, not the cause of attention. In the current language of psychology this proposition is reversed and the cart is put before the horse; for in reflection the question is not of directing consciousness or attention to an idea, but of giving to an idea sufficient intensity so that it will impress itself in consciousness."*

A doubtful point still remains. If we concede that the general mechanism of attention is motor, and that in the special case of voluntary attention it consists chiefly in an act of inhibition, the question remains, How is this inhibition produced, and on what does it act? The question is a difficult one and we can do little beyond stating it; nevertheless it is better to attempt an answer, though only a conjectural one, than to appear to elude the difficulty.

It will be perhaps not unprofitable to look for light in a similar class of phenomena though of less complex kind.

Reflex actions, whether those which are natural and innate or those which are secondary, acquired, fixed by repetition and habit, are produced spontaneously, unhesitatingly, without effort, and may be continued a long time without fatigue. They call into action those elements in the organism which are necessary for their production, and their adaptation is perfect. In the strictly motor order they are the equivalents of spontaneous attention, which itself is an intellectual reflex action, involving neither choice, nor hesitation, nor effort, and it can be continued for a long time without fatigue.

But there are other kinds of movement, more complex and artificial, for instance, writing, dancing, fencing, all bodily exercises, the mechanic trades, etc. Here the adaptation is not natural, but has to be acquired by hard effort. It requires choice, experiment, effort, and at first is accompanied by fatigue. Daily observation proves that at first there are produced a great many useless move-

ments: thus, the child learning to write moves arms, eyes, tongue, head, etc. The end to be attained is to prevent this diffusion and by means of appropriate associations and disassociations to produce the maximum of useful work with the minimum of effort. The reason is that there are no isolated movements, and that a contracting muscle acts on its neighbor muscles, often on many of these. One attains the end after repeated attempts by some lucky chance—awkward persons slowly or not at all, those who are handy, speedily. But the mechanism is ever the same: it consists in reinforcing certain movements, coördinating them in simultaneous groups or in a series, while the others are suppressed—*inhibited*.

Voluntary or artificial attention proceeds in the same way. When one prepares to enter this state, he sees states of consciousness coming up in groups or in series, for states of consciousness are never isolated any more than are movements. Among them many do not help the main purpose, or even take us away from it. Then, states of consciousness that are useless or harmful have to be suppressed: if possible a large part of our task consists of this negative work by which the intruders are shut out of the consciousness or reduced to their minimum intensity. How is this done? Either we must abandon all explication, or we must admit an act of inhibition exercised over the motor elements of these states of consciousness. In such cases we have a very clear sense of effort made. And whence could that come if not from the energy expended in producing the acts of inhibition, for the ordinary course of thought, left to itself, is exempt from that feeling. If it be objected that in this view the fundamental mechanism of voluntary attention remains hidden, we reply that the fundamental mechanism of every volition is also hidden. Only the two extreme terms, the beginning and the end, enter the consciousness: all the rest belongs to the physiologi-

*"Physiology of the Mind."

cal domain, whether it be a question of doing or hindering, of producing a movement or an inhibition.

Attention is a momentary, provisional state of the mind, not a permanent power like sensibility or memory. It is a form (the tendency to monoideism) impressed upon a *materia* (the ordinary course of states of consciousness): its starting-point is either in the chance condition of circumstances (spontaneous attention), or in the positing of an end determined before hand (voluntary attention). In both cases affective states, tendencies must be awakened. There we see the primal *direction*. These lacking, all fails; if they are vacillating the attention is instable; if they do not persist attention vanishes. But a state of consciousness having thus become preponderant, the mechanism of association comes into play in its manifold forms. The work of *direction* consists in choosing appropriate states, keeping them (by inhibition) in the consciousness so that they in turn may proliferate, and so on by a series of choices, inhibitions, and reinforcements. Attention can do no more; it creates nought, and if the brain is barren, if the associations are meager, it functions in vain. Voluntarily to direct the attention is for many persons an impossibility, difficult for all.

III. As everyone knows by experience, voluntary attention is always accompanied by a feeling of effort which is directly proportioned to the time attention is kept up and to the difficulty of maintaining it. Whence comes this feeling of effort, and what is its meaning?

Attentional effort is a particular case of effort in general, of which the most familiar manifestation is that which accompanies muscular work. Three opinions have been held with regard to the origin of this feeling:

1. It is of central origin: it is prior to movement or at least simultaneous; it proceeds from within

outward; it is centrifugal, efferent; it is a feeling of energy deployed; it does not, as is the case with sensation properly so called, result from an exterior influence transmitted by the centripetal nerves. (Bain).

2. It is of peripheric origin: it is posterior to the movements produced; it proceeds from without inward; it is afferent; it is the sense of energy that *has been* deployed; it is, like all sensations, transmitted from the periphery of the body to the brain by the centripetal nerves. (Charlton Bastian, Ferrier, W. James, and others).

3. It is both central and peripheric: there is such a feeling of force exerted, or a feeling of innervation, and there is also a feeling of movement effected; it is first centrifugal, then centripetal. (Wundt). This mixed theory seems also to be that of Johannes Müller, one of the first to study the question.

The second thesis, which is the most recent, seems to be the best founded. It has been set forth with great fullness by W. James in his monograph "The Feeling of Effort" (1880), and the thesis of the feeling of energy deployed, prior to movement, is there criticized with great acumen. In discussing the facts one by one, the author has shown that, in cases of paralysis of a portion of the body, or of an eye, if the patient has the feeling of an energy deployed though the member remains motionless (which seemingly justifies the thesis of a feeling of central innervation anterior to movement), the reason is because there is really a movement produced in the other half of the body, in the corresponding member, or in the eye that is not paralyzed. Hence he infers that this feeling is a complex afferent state arising out of contraction of the muscles, extension of the tendons, ligaments, and skin; from compressed articulations, closed glottis, tight-shut jaws, etc.; that in a word it is, like all sensations, of peripheric origin. Even

for those who will not accept this view as settling the matter, it is certain that it explains the facts far more satisfactorily and in a way more in accordance with the general laws of physiology, than does the hypothesis which refers this feeling to the motor nerve discharge, the motor apparatus being insensible in the centripetal direction.

Let us now consider the special case of attentional effort. The old school psychologists contented themselves with simply determining its existence, but they do not explain it. They speak of it only in vague phrases, calling it a "state of the soul" an hyperorganic manifestation. In it they see "an action of the soul upon the brain to call it into action." Fechner, I think, was the first (1880) to attempt precisely to localize the different forms of attention, by referring them to determinate parts of the organism. Hence the following passages seem to me worthy of reproduction as showing an attempt at an explanation:

"The feeling of attentional effort in the various sense organs seems to me to be simply a muscle-sense (*Muskelgefühl*) produced by putting in action, by a sort of reflex act, the muscles related to the different sense organs. The question then arises: To what muscular contraction is the attentional effort related, when we strive to recall anything? My inward sense gives me a clear answer upon this point. I experience a very distinct sensation of tension, not in the interior of the cranium, but as it were a tension and a contraction of the skin of the head and a pressure from without inward over the whole cranium, evidently caused by a contraction of the muscles of the skin of the head. In an illness I once suffered, during which I could not stand the slightest effort of continuous thought (and at that time I was not committed to any theory), the muscles of the skin, in particular those of the occiput, were very plainly in a state of morbid sensibility whenever I tried to reflect."

In the following passage Fechner describes this feeling of effort, first in sensorial attention, then in reflection:

"If we transfer our attention from the domain of one sense to that of another, we immediately experience a definite sense of change of direction—a feeling hard to describe but which any one may reproduce experimentally. We call this change a tension diversely localized.

"We feel a tension directed forward in the eyes, directed to one side in the ears, and differing with the degree of attention, accordingly as we regard attentively or listen attentively to something: hence it is that we speak of the effort of attention. We are very clearly sensible of the difference when we change rapidly the direction of the attention from the eye to the ear. So too the feeling is localized differently accordingly as we wish carefully to smell, taste, or touch an object.

"Whenever I would represent to myself very clearly a recollection or an image, I have a feeling of tension much like that of attentive vision or hearing. This quite analogous feeling is localized in a manner totally different. For whereas in attentively looking at real objects as well as in contemplating consecutive (mental) images, the tension is felt in front, and in directing attention to the other sensorial domains, the only thing that changes is the direction toward the exterior organs, the rest of the head giving no feeling of tension: on the contrary, in the case of recollection and of images, I have a consciousness that the tension withdraws entirely from the external organs of sense, and seems rather to occupy the part of the head filled by the brain. If I wish, for instance to represent vividly to myself an object or a person, they seem to come up to me all the more vividly the more I strain my attention not forward, but so to speak backward."*

*"Elemente der Psychophysik," vol. II., p. 475, 490.

Since the publication of Fechner's work the researches of Duchenne already mentioned, as also those of Darwin and of the authors who have studied the movements of expression, have thrown much light upon the subject. Note also the rôle of the respiratory movements, of which Fechner does not speak. So important are they, that in certain cases they of themselves produce the feeling of effort, as Ferrier has shown by a very simple experiment. If you stretch an arm, holding the index finger in the position needed for drawing the trigger of a pistol, you can, without actually moving the finger, experience the feeling of energy deployed. Here then is a clear case of the feeling of energy deployed, without any real contraction of the hand-muscles, and without any perceptible bodily effort. That is Bain's view. "But," says Ferrier, "if the reader recommences the experiment and attends to the state of the respiration, he observes that his consciousness of effort coincides with a fixation of the pectoral muscles, and that in proportion to the sum of energy which he feels set in action by him, he keeps the glottis shut, and actively contracts his respiratory muscles. Let him place his finger as before and *keep on respiring* all the time, and he will find that however strongly he may direct his attention upon the finger, he will have not the slightest trace of consciousness of effort, until the finger itself has been actually moved, and then the consciousness of effort is referred locally to the muscles that act."

To sum up, we see always muscular contractions. Even when we stand motionless, we find, if we observe closely, that intense reflection is accompanied by a beginning of speech, of movements of larynx, tongue, lips. In those who do not belong to the "motor" type, and who therefore are least favorable to our view, there is a state of ideal audition or of ideal vision: the eye,

though shut, is fixed on imaginary objects. Czermak, and after him Stricker have shown that if, after contemplating inwardly the image of an object supposed to be very near, we pass suddenly to the mental vision of a very distant object, we feel a change in the innervation of the eyes. In real vision, in a like case, one passes from the state of convergence to that of parallelism of the visual axes, that is, he has to innervate the motor muscles of the eye in a different way. The same operation, fainter, in the nascent state, takes place in the interior vision which accompanies reflection. Finally, in all persons and in every case there are modifications in the respiratory rhythm.*

We can now answer the question already raised: what is the origin of the feeling of effort in attention, and what is its meaning?

It has its origin in those physical states so often enumerated, and which are the necessary conditions of attention. It is simply their echo in consciousness. It depends on the quantity and quality of the muscular contractions, on organic modifications, etc. Its starting-point is in the periphery, as is the case with all other sensations.

It means that attention is an abnormal state, not lasting, causing rapid exhaustion of the organism; for when the effort is over there is fatigue, and after the fatigue comes functional inactivity.

There remains one obscure point.

*Mr. Guge, of Amsterdam, has recently given the name of *aprosopie* (Gr. α privative, and $\pi\rho\omicron\varsigma\epsilon\lambda\epsilon\upsilon$, to attend) to incapacity to fix attention on a definite object, in consequence of a diminution of the nasal respiration due to certain circumstances, such as adenoid tumors in the pharyngo-nasal cavity, polypus of the nose, etc. A child of seven years had failed to learn at school through an entire year more than the first three letters of the alphabet. After undergoing an operation for its adenoid tumor, the child in one week learned the entire alphabet. Some gymnasium students, similarly affected, were unable to learn anything. They felt that every effort to fix their attention produced headache and vertigo. They could without fatigue read a phrase six to ten times, but without understanding what they read, though they were not thinking of anything else. This circumstance differentiates this state from ordinary distraction of mind. ("Biologisches Centralblatt," Jan. 1, 1888).

When we pass from the ordinary state to the state of sensorial attention or of reflection, there is produced an augmentation of work. The man who is exhausted by a long walk, or by a strong mental effort, or who succumbs to sleep at the end of a day's labor; the convalescent recovering from a serious illness, in a word, all persons who are debilitated, are incapable of attention because, like other forms of work, it calls for a reserve capital that may be expended. In the transition from the state of distraction to that of attention, therefore, there is a transformation of tension force into *vis viva*, of potential into actual energy. Now this is an *initial* moment very different from the moment of the effort felt, which is an effect. This remark I make in passing, but do not dwell upon it. The examination of this question cannot be made with advantage till we shall have studied our entire subject.

4. Experimental research upon voluntary attention has confirmed and made more definite certain conclusions which in any case follow from an exact comprehension of the subject. Such research is either direct or indirect, accordingly as it investigates attention in itself and in its individual variations, in the normal and in the morbid state, or as it investigates it as the means, the instrument of other researches upon the duration of sense-perceptions, associations, judgment, choice, etc. Attention is in fact the fundamental psychic condition of nearly all psychometric researches.*

Obersteiner, in whose view attention is essentially a fact of inhibition, finds that generally it requires a longer time in the ignorant than in cultivated persons, in women than in men, who by their mode of life devel-

op the power of inhibition, in the aged than in persons in middle age and youth: the fact indicates no doubt a less rapid functional development.

A series of experiments made upon the same person gave us the mean in the normal state 133 σ ,* in the case of headache 171 σ , in that part of fatigue and sleepiness, 183 σ . In a patient at the onset of general paralysis the mean time was 166 σ ; in the second stage of that disease, while the state of the patient was still entirely compatible with investigation, the result obtained was 281 σ up to as high as 755 σ . Again, Mr. Stanley Hall, who had the good fortune to find a subject able in the hypnotic state to react correctly, met with a very perceptible diminution of the time, ranging from a mean of 328 σ (normal state) to 193 σ (hypnotic state)—a result that was to be anticipated in view of the monodeism peculiar to hypnotism.

Wundt and Exner have made other experiments on the normal individual. At times the subject is taken in the state of distraction, the impression to which he is to read coming unforeseen and without being determined in advance. Again the impression is determined so far as concerns its nature and energy, not as to the time at which it is to be produced. Anon the impression is completely determined (as to its nature and time), a signal notifying the patient that the impression is about to follow. In this progressive advance from indetermination to determination, the reaction time keeps ever declining, as we might have anticipated. Thus while in the case of mental distraction it may rise to the enormous figure 500 σ , in the second case it falls to 253 σ , and with the signal to 76 σ .

These experiments present in its simplest form the state called *expectant attention*, or *pre-attention*. They suggest some considerations corroborative of what has been already said.

If in expectant attention we con-

*For particulars about experiments, consult "Experimental Researches on Attention" in "Brain," Jan. 1879; Wundt, "Psychologie Physiologique," vol. II., ch. xvi; Exner, in Hermann, "Handbuch der Physiologie," vol. II., part 2, p. 283 et seq.; J. Stanley Hall, "Reaction Time and Attention in the Hypnotic State" ("Mind" Apr. 1883).

* σ = 1000th part of a second.

sider only the *intellectual* side, we find it to be a preparatory stage in which is called forth the image of an event foreseen or presumed. The state of *monoideism* is constituted, so that the real event is but the reinforcement of the preëxisting representation. In some experiments two almost simultaneous impressions are produced, and the question is, which is prior in time. If the impressions are of different kinds, one auditive (a stroke on a bell), the other visual (an electric spark), there is a tendency to consider as prior either the stronger impression or that toward which the attention was directed while pursuing these researches. Wundt was able at will, according to the direction given to his attention, to see now the one again the other as prior. When the two excitations are of the same kind, we notice distinctly only the first, and the second passes unnoticed.

If we consider the *motor* aspect of expectant attention, we see that it produces a preparatory innervation of the nerve centers and muscles, which at the least shock may be converted into a real impulsion. Thus the representation can by itself produce a reaction, without external cause.

This explosive state is produced especially in cases where the expected impression is indeterminate, in cases that might be called expectant attention in general. The motor innervation is distributed among all the sensorial domains: there is then produced a feeling of disquietude and discomfort, of tension so that the falling of a body or any laboratory mishap brings about an automatic reaction.

When the expected impression is fully determined, the motor innervation has its way traced in advance; instead of being diffused, the tension is localized. The reaction time may be null or even a negative quantity.

When the reaction has to be made by different processes or in response to different excitations, there must

be produced a change in the centers which shall effect a change in the direction of the nerve routes: it is a very fatiguing state.

We must also mention the experimental researches of N. Lange upon the oscillations of sensorial attention. In the stillness of night the ticking of a watch situate at some distance sometimes is not heard, again is reinforced; the same is to be said of the sound of a water fall; and similar oscillations have been observed with regard to visual and tactual sensations. These variations are subjective, not objective. Must we, as is commonly done, attribute them to fatigue of the sensorial organ? Lange thinks not; according to him they have their cause in the brain and are due to oscillations of attention. When one attends to two simultaneous excitations, one optical the other acoustic, if the oscillations are of peripheric origin they must be independent of each other. But such is not the case: the two kinds of oscillations never coincide; they are always separate by a clearly defined interval. What is the cause of this periodicity of oscillations? According to Lange, it is the oscillation of the images which accompany sense-perception. The reinforcement existing in the attention results from the fact that to the actual impression is added the image of a prior one. Sensorial impression would seem to be an assimilation of the real impression, which remains motionless, with the prior image, which is subject to oscillations.* We find, in short, that attention in no wise resembles a pure activity, that it is tied to clearly determined physical conditions, that it acts only through these and depends upon these.

CHAPTER IV.

MORBID STATES OF ATTENTION.

To complete this study of attention,

*Lange, "Beiträge zur Theorie der sinnlichen Aufmerksamkeit und der activen Apperception," in "Philosophische Studien," 1887.

it remains for us to examine morbid cases. I do not purpose to attempt a pathology of attention: the title were too ambitious and the undertaking premature; but these are facts overlooked by psychology, though they are familiar; and these it is well to review. The reader will see their importance for a better understanding of the mechanism of normal attention.

In current language, to attention is opposed the state of "distraction," but this word, both in French* and other languages is used in different senses. It denotes states of mind apparently much alike but which at bottom are contrary to one another. These are said to be "*distracts*" whose intelligence is incapable of being fixed with any degree of stability, who are ever passing from one thought to another, according to every passing change of humor or of the circumstances. It is a perpetual state of mobility and is the very reverse of attention: it is frequently seen in children and in women. But the word "distraction" is also applied to cases quite different from this. People who are absorbed by one idea, and "distracted" from things around them, give little opportunity to outer occurrences to take hold of them; these glance off them and do not penetrate their minds. Such persons seem incapable of attention just because they are highly attentive. Many scholars are famous for their "distraction" in this sense, and so numerous are the instances of this that it is needless to cite any. While the "*distracts dissipés*"† are characterized by an incessant wandering from one thought to another, the "*distracts absorbés*" are characterized by the impossibility or the great difficulty of passing from thought to thought. These are riveted to their thought—they are prisoners that do not want to escape.

In fact, their state is a mild form of the morbid condition which we will study later under the name of "fixed idea."

But these every-day manifestations, these different forms of "distraction" are after all not so instructive as are cases clearly pathological. Without attempting anything like a scientific classification of these, we will endeavor to group them according to a natural system. Here our starting-point must be the normal attention, and we have to note its several varieties and deviations. Some authors have studied the disordered states of attention and have referred them to the different types of mental disease, such as hypochondria, melancholia, mania, dementia, etc. This procedure not only leads to endless repetitions, but furthermore is subject to this grave defect that it does not place in a clear light the fact of attention. It is studied not in itself, but as a symptom. On the contrary, for us it is a primary fact; all the rest is accessory. The morbid forms must be referred to the main trunk—the normal state—and their relations must be clearly understood: on this condition alone can pathology afford us any instruction.

If, as has been already said, attention is the *temporary* dominance of an intellectual state or group of states, with natural or artificial adaptation of the individual, we can distinguish these deviations:

1. *Absolute* predominance of one state or group of states, which becomes stable, fixed, and which cannot be dislodged from the consciousness. We have not now merely an antagonist of spontaneous attention, its one function being to govern it: on the contrary, we have a destructive, tyrannical power which subjects all to itself, which permits development of thought only in one direction, which allows the current of consciousness to flow only in one narrow channel, and which sterilizes more or less whatever is outside it

*The remarks which follow apply to French rather than to English: nevertheless it has been deemed best to give them unaltered. *Translator.*

† The first class of *distracts* mentioned above.

domination. Illustrations of this are seen in hypochondria, and better still in fixed ideas and in ecstasy. These constitute the first morbid group, which I shall call *hypertrophy of attention*.

2. In the second group I shall class cases in which attention cannot be sustained, or even cannot exist at all. This state is owing to two principal causes. Sometimes the flow of thoughts is so rapid, so exuberant, that the mind becomes purely automatic. In this uncontrolled flood of ideas no one state is stable, no one state predominates; there is no center of attraction, even for a moment. Here the mechanism of association is in full play: it acts alone, with all its force, without any counterpoise. Instances of this are seen in some forms of delirium and particularly in acute mania. At other times, while the mechanism of association does not exceed the average of intensity, there is absence or diminution of the power of inhibition. Subjectively, this state implies impossibility or extreme difficulty of effort. There is no convergence whether spontaneous or artificial; the thoughts, are ever in flux, scattered, and unrelated, of this we see instances in hysterical subjects, in convalescents, in apathetic and insensible patients, in intoxication, in the state of extreme bodily or mental fatigue, etc. This lack of power coincides, in short, with all forms of exhaustion. This group we designate, in opposition to the other, *atrophy of attention*.

The first group of morbid states, it may be remarked in passing, has to do rather with spontaneous attention, the second rather with voluntary. The one is an evolution and is in the *plus* direction, the other is a dissolution and is in the direction of *minus*. Here pathology verifies what has already been said. Voluntary attention, like all things artificial, is precarious, vacillating. Disease does not transform it, but rather breaks it up. Spontaneous attention, like

all natural forces, may be magnified beyond all limits, yet it is only transformed. Essentially, its nature is not changed; it is as when a light wind becomes a tempest.

3. The third group comprises not morbid forms of attention, but a congenital infirmity, as when spontaneous attention or *a fortiori* voluntary attention does not appear at all, or appear only by flashes. This is seen in varying degrees in idiots, imbeciles, the weak-minded, and the demented. After this rapid classification we proceed to details.

I. There is an almost insensible transition from the normal state to the most exaggerated forms of the fixed idea. Every one knows by experience what it is to be haunted by a musical air or by some trivial phrase that is ever recurring to the mind without assignable cause. That is the fixed idea in its least pronounced form. The state of preoccupation brings us to a higher stage: the thought of a sick person that one has to care for, of an examination to be passed, of a long voyage to be made—such thoughts act by repetition, but do not constitute a real "obsession" of the consciousness. Despite its intermittence, the thought is ever alive, and is ready at any moment to emerge suddenly out of the under-current of unconsciousness: it has more stability than any other thought, and its momentary eclipses do not prevent it from playing the principal part. In every sane person there is almost always one dominant thought which dominates his conduct—the thought of pleasure, money, ambition, his soul's salvation, and the like. This fixed idea which persists through life, save where it is superseded by some other, finally becomes a fixed passion—which proves once again that attention and all its modes depend upon affective states. The transformation of attention into a fixed idea is seen still more clearly in great men. "What is a great life?" said Alfred de Vigny. "A thought of youth realized in mature

age." For many a celebrated character this "thought" has been so absorbing, so dominating that one can hardly refrain from regarding it as morbid.

The transformation of spontaneous attention into a decidedly pathological fixed idea, is clearly seen in hypochondriacs. We can trace its evolution through all its stages—and the stages are many, ranging from the slightest form of preoccupation to complete obsession. Though this mental malady cannot germinate and grow except in a favorable soil, and though consequently it presupposes certain physical and mental conditions, it does not at the outset rise above the mean level of spontaneous attention: the exaggeration takes place only little by little. And it matters little whether the sufferings of the patient be real or imaginary: from the psychological, subjective point of view it is all one. As we know, the mere act of fixing the attention upon a portion of the body,—the heart, stomach, bladder, intestines—produces in consciousness unwonted sensations: an illustration of the general law that every vivid state of consciousness tends to actualize itself. Some men are peculiarly gifted in this respect. Sir Benjamin Brodie said that he could feel pain in any region of his body whatever, by strongly fixing his attention thereon. Now "fixing attention" means simply letting a given state continue or predominate. This predominance, at first quite harmless, grows by the very effects it produces. A center of attraction is formed which little by little gains the supremacy in the consciousness. It is then an unceasing preoccupation, a continual observation upon the state of each organ and the products of each function: in short we have a case of perfect hypochondria as it has been a thousand times portrayed.

But there are fixed ideas more extraordinary, more rare, which, because of their purely intellectual nature, are as it were the caricature

of reflection. These are fixed ideas properly so called. They have been very carefully studied by sundry authors in our time.* Unfortunately the memoirs and collections of observations that we have upon this subject have hardly come from the domain of psychiatry, and hitherto psychology has profited little by them, at least as far as attention is concerned.

It is pretty well agreed that fixed ideas are to be classed in three great categories:

1. Simple fixed ideas of a purely intellectual kind, which usually are confined to the consciousness, or which have no outward expression save in insignificant acts.

2. Fixed ideas accompanied by emotions such as terror and anxiety (agoraphobia, *folie du doute*, etc.)

3. Fixed ideas of the impulsive kind, known as "irresistible tendencies," which express themselves in violent or criminal acts, as robbery, homicide, suicide.

Though there is no sharp line between the three classes, it may be said that the first has for its specific character a disordered state of the intelligence, that the second belongs rather to the affective order, and that the third depends upon a weakening of the will. The latter two will be rigorously excluded from our study, because they have to do with the pathology of the feelings and the will. It is best to deal with cases free from all foreign admixture, to such as are strictly comparable with the state of relative monoideism which we call attention.

Even when we restrict ourselves

* Westphal, "Ueber Zwangsvorstellungen" (in "Archiv für Psychiatrie," 1878); Berger, "Grübel-sucht und Zwangsvorstellungen" (*ibid.*, vol. VIII.); Kraft-Ebing, "Lehrbuch der Psychiatrie," and "Ueber Geistesstörungen durch Zwangsvorstellungen" ("Zeitschrift für Psychiatrie" vol. XXXV.); Griesinger, "Ueber ein wenig bekannten Psychopathischen Zustand" ("Archiv für Psych." vol. I.); Meschede, "Ueber Krankhafte Fragesucht" ("Zeitschr. für Psych., vol. XXVII.); Buccola, "Le Idee Fisse e le loro Condizione Fisiopatologiche" (1880); Tamburini, "Sulla Pazzia del Dubbio e sulle Idee Fisse ed Impulsive" (1883); Luye, "Des Obsessions Pathologiques" (*Encéphale*) 1883; Charcot et Magnan, "De l'Onomatomanie" ("Archives de Neurologie, 1885.)

to this group, instances of fixed ideas are not wanting. They have received different names according to their dominant characters. In some persons the fixed idea takes a mathematical form (arithmomania)—why have persons such or such a stature? why have houses such or such a size? trees such or such a height? and so on for every separate object. Oftener, a person keeps ever counting, adding, multiplying. "A certain woman who showed many symptoms of hysteria could not look into a street but at once she would involuntarily begin to count the paving stones, then those of all the streets of the town, of all the towns in Italy, and so on. If she saw a bag of wheat, straightway began in her brain the work of counting the grains of wheat in the town, the neighborhood, the whole country . . . She confessed that not only did she feel constrained by an irresistible force to make these odd calculations, but that these fixed ideas were so well organized that if while performing the hard task she had to stop out of sheer inability to pursue it farther or from any other cause, she felt keen distress, nay she endured unspeakable bodily suffering."* I know of a young man who spends the greater part of his time in calculating the time of starting and of arrival of each train at each railroad station all over the world. He even makes a present of railroads to countries that have none, and regulates at his pleasure the imaginary traffic. He draws up highly complicated time-tables covering huge sheets of paper. He is a man of great intelligence.

Another form of the fixed idea consists in putting questions without end upon some abstract problem that the patients themselves hold to be incapable of solution. This the Germans call *Grübel sucht*, in English it goes by the name of "metaphysical mania." The interrogative form peculiar to it obtains for it in German the name of *Fragetrieb*. A man

whose case was observed by Griesinger, could not hear the word "beautiful" without putting to himself, whether he would or no, an endless and inextricable series of questions upon the most abstruse problems of æsthetics. The word "being" put him in a quandary of metaphysical speculation. This man, who was highly educated, says of himself: "I am ruining my health in thinking continually of these problems which reason never can solve, and which, notwithstanding my strongest efforts of will, are ever wearying me . . . This metaphysical reflection is too continuous to be natural . . . Every time that these thoughts come to me I strive to dismiss them and I try to persuade myself to pursue the natural course of thought, not to puzzle my brains with arguments full of obscurity, not to give myself up to meditating upon abstruse and insolvable questions. But I cannot withstand the continual impulsion, the unceasing fixed tendency which is ever present to me and leaves me no moment of quiet."*

I give one more illustration of the fixed idea, taken from Tamburini, because of its purely intellectual character: "A young law student, of neuropathic parentage, was dominated continually by thoughts about the origin, the why and the how of the circulation of bank notes. This thought kept his attention always strained, made it impossible for him to occupy his mind with any other, stood between the outer world and him, and strive as he might to rid himself of it, it was impossible for him to do it. Notwithstanding his long study of the subject and his many researches upon the problem, thinking himself unfitted for all other mental labor, he fell into such a state of sadness and apathy that he wanted to suspend his studies. . . . His sleep was insufficient and broken; often he lay awake for nights together, ever absorbed by his dominant

* Roncati, *apud* Buccola, *op. cit.*

* Griesinger, *op. cit.*

thought. A singular phenomenon must be noted. In consequence of his continual mental tension upon the problem of the bank notes, at last he came to have ever before his eyes pictures of bank notes, in all their different shapes and sizes and colors. The idea, ever repeated and impressed upon him with intensity, came to have a force of projection which made it equal to the reality. Still he was always fully conscious that the images before his eyes were but a play of his imagination." Appropriate medical treatment and a few very lucid explanations given by a professor improved his situation. "The veil that enveloped his mind, after it had been removed with regard to large notes, remained with regard to those of small value, those for fifty centimes for instance; the image of these continued to appear to him." At last all his troubles disappeared.

It will perhaps be said: "These people and their kind are madmen." True, they are not sane minds, but the epithet "madmen" is undeserved. They are persons debilitated, or who have lost mental balance. Mental co-ordination, always precarious and irritable, gives way at the slightest shock; but that is a loss of equilibrium, not a fall. Authors who have investigated the determining causes of fixed ideas, all reach the same conclusion—that it is a symptom of degenerescence. We might say: Not whoever will has fixed ideas. There is a prime condition always requisite, namely, a neuropathic constitution. It may be hereditary, or it may be acquired. Some persons are born of parents to whom they are indebted for the sad legacy of a degenerated organism. This is by far the more numerous class. The others are exhausted in consequence of their mode of life—by physical or mental fatigue, emotions, strong passions, sexual or other excess, anæmia, debilitating diseases, etc. Finally, the same result is reached by both routes. Hence the fixed

idea, even in its simplest form, that which we are considering, and which appears wholly theoretical and confined within the field of intellectual operations, is nevertheless no purely interior occurrence, without physical concomitants. Quite the contrary, the organic symptoms accompanying it indicate a neurasthesis; these are, headaches, neuralgia, feeling of oppression, disorders of motility, of the vaso-motors and of the sexual functions, insomnia, etc. The psychic phenomenon of the fixed idea is but one effect among many of one same cause. Still, if it suffices for the physician to trace these multiple manifestations to a single source, degenerescence, the task of the psychologist is much more difficult. In addition to the general cause, it is for him to find the special causes in each case. Why does such or such a form prevail with a given individual? Why does the fixed idea in one person take the form of counting, in another, of metaphysical speculation, and so on? What are the secondary causes which have given this direction or that? Each case would have to be studied separately. Supposing that this research can be successful, it were best to begin with the graver cases, those which we have eliminated. In reality, they are the more simple, and as some of them are related to a determinate organic apparatus (e. g. the fixed idea in some subjects of erotomaniacs) that would be a starting-point and a clue. But to apply direct to the intellectual forms of the fixed idea psychological analysis, were to condemn one's labor to failure. However, we have not to undertake that task here. Our one purpose is to examine more closely the mechanism of the fixed idea, to see wherein it resembles the mechanism of attention, and wherein it differs from it.

And to this we may answer straightway: Between the two there is no difference of kind, only of degree: the fixed idea has greater

intensity and above all greater duration. Take a case of spontaneous attention; suppose that we can by artificial means reinforce it and particularly that we can make it permanent: there the transformation into a fixed idea is complete; the whole train of irrational conceptions that attend upon the fixed idea and give it the false appearance of insanity, will be added of necessity, by the mere effect of the logical mechanism of the mind. The term "fixed idea" designates the principal part of the entire psychological state, but only a part—the center from which all sets out, to which all returns. The permanence of one image, one idea—that and nothing more—is a contradiction of the conditions of consciousness, which demands change. *Absolute* monoideism, if that exists, occurs if at all only in the highest forms of ecstasy, as we shall see later. The mechanism of the fixed idea consists in associations of states of consciousness in one only direction—associations at times loose and but little coherent, oftener held together by a close logical bond which expresses itself in never-ceasing interrogations.

Some authors, Westphal in particular, in noting the differences between the fixed idea and mental disorders qualified as "insanity," have made this important remark: "The fixed idea is a *formal* change in the process of ideation, not in its contents;" in other words, there is a change not in the nature, the quality of the idea, which is normal, but in its quantity, its intensity, its degree. To reflect upon the origin of things, or on the circulation of bank-notes, is a perfectly rational act, and that mental state is in no wise comparable with that of the beggar who thinks himself a millionaire or of the man who believes he is a woman. The "formal" disorder consists in the stern necessity which compels the association always to follow one path. As there are intermittences, momentary changes of direction, the

patients, whose intelligence is quick and their cultivation of no ordinary degree, are fully conscious of the absurdity of their state: the fixed idea appears to them as a foreign body lodged in them which they are unable to rid themselves of; but it falls short of possessing them wholly, and remains an "aborted delirious idea."

This *formal* character of the fixed idea shows its close relationship to attention. Attention, as we have often said, is only a mental attitude. Perceptions, images, ideas, emotions are its subject-matter; it does not produce them, does but isolate them, reinforce them, bring them to the light; it is only a *mode*. Common speech itself draws a distinction between the ordinary form and the attentive form of states of the mind.

Hence I am fully disposed to agree with Buccola that "the fixed idea is attention in its highest degree—the uttermost term of its inhibitory faculty." There is no line of division, not even a fluctuating one, between them; and, to sum up, if we compare them with each other, here is what we find:

1. In both cases, we see predominance and intensity of a state of consciousness, only these are higher in the case of the fixed idea. This, by reason of its organic conditions, is permanent—it lasts; it has to do with a highly important psychological factor—time.

2. In both cases the mechanism of association is limited. This exceptional state lasts but a short time in attention; consciousness returns spontaneously to its normal state, which is a struggle for existence between heterogeneous states. The fixed idea prevents all diffusion.

3. The fixed idea presupposes—this is one of the usual effects of degenerescence—a notable weakening of the will, i.e., of the power to react.

There is no antagonist state that can reduce it. Effort is impossible or fruitless. Hence, the distressed

state of the patient, who is conscious of his impotence.

Physiologically, we may probably represent the condition of the fixed idea as follows: In the normal state, the whole brain acts: the activity is distributed. Discharges take place between one group of cells and another, and this is the objective equivalent of the unceasing changes of the consciousness. In the morbid state, some of the nervous elements only are active, or at least their state of tension does not pass to other groups. It is not necessary that the nervous elements should occupy a point or a limited region of the brain; they may be scattered if only they be closely associated for the common work. Whatever be their position in the cerebral organ, they are in fact isolated: all the disposable energy is accumulated in them and they do not communicate it to other groups: hence their exaggerated activity. There is a lack of physiological equilibrium, due probably to the state of nutrition of the brain centers.

Esquirol called the fixed idea a catalepsy of the intelligence. We may also compare it to a phenomenon of the motor system—contracture. A contracture is a prolonged constriction of the muscles; it depends upon an excess of irritability of the nerve centers: the will is powerless to break it up. The fixed idea has a like cause; it consists of an excessive tension, and the will has no control over it.

II. The fixed idea might be called the chronic form of hypertrophy of attention: ecstasy is its acute form. We have not to study in its entirety this extraordinary mental state. In another place* we have studied it on its negative side—abolition of will-power; we are now to consider its positive side—exaltation of the intellect.

To compare attention with ecstasy is nothing new: so great is the anal-

ogy between the two states that many authors have made use of attention in defining ecstasy. "It is," says Bérard, "a vivid exaltation of certain ideas which so absorb the attention that the sensations are suspended, the voluntary movements arrested, even the vital action often slowed." Michéa defines ecstasy as "profound contemplation, with abolition of sensibility and of locomotor power." A. Maury is still more explicit: "A mere difference of degree separates ecstasy from the act of strongly fixing an idea in the mind. Contemplation implies furthermore the exercise of will and the power of stopping the extreme tension of the mind. In ecstasy, which is contemplation carried to its highest power, the will, though it can produce the ecstatic state, is powerless to suspend it."*

As with the fixed idea, so in the state of ecstasy there are intermediate degrees. Persons who have great power of attention are able at will to isolate themselves from the outer world. Inaccessible to sensations and even to pain, they live temporarily in the special state called *contemplation*. The oft-quoted anecdote of Archimedes at the taking of Syracuse, whether true or false, is true at least psychologically. The biographers of Newton, Pascal, Sir W. Scott, Gauss, and many others, give instances of this rapture of the intellect.

"Before the discovery of chloroform, patients sometimes underwent serious operations without giving any sign of pain, and they would afterward declare that they had felt nothing, having concentrated their thoughts, by a strong effort of attention, upon some subject that engrossed them completely.

"Many martyrs have suffered torture with a perfect serenity, which, as they said, they had no difficulty in maintaining. Their entranced attention was so filled with the beatific visions that occurred to their rav-

*"Diseases of the Will," Chapt. VI. ("Humbolt Library," No. 52.)"

*Maury, "Le Sommeil et les Rêves," p. 235.

ished gaze, that corporal tortures caused them no pain.*

Political fanaticism has repeatedly produced similar effects. But everywhere and always it is strong passion that serves as the ground-work—showing once more that vivid and stable forms of attention depend upon the affective life and upon that alone.

Let us pass over the intermediate degrees and consider ecstasy proper, and let us dismiss all the other physical and psychic manifestations that accompany that extraordinary state, and look only at one particular fact—the extreme intellectual activity, with concentration upon one single idea. This is an intense, circumscribed state of ideation; the whole life is brought together in the thinking brain, where one single mental representation absorbs all. Still ecstasy, though in each individual it raises the intelligence to its highest power, cannot transform it. It cannot act upon a narrow and ignorant mind as upon a broad and highly cultivated one. Hence we may distinguish two categories of mystics. In some, the interior phenomenon consists of the apparition of a dominant *image* around which all else is centered (the Passion, the Nativity, the Virgin Mary, etc.), and which finds expression in a regular series of movements and speeches. Instances: the cases of Marie Mærl, Louise Lateau, the ecstasica of Voray. In others—in the greater mystics—the mind, after traversing the region of images, attains the region of pure ideas, and there becomes fixed. I will endeavor to show, later, that this higher form of ecstasy at times produces complete, absolute monism, that is, perfect unity of consciousness—one sole state of consciousness, without any changes.

To trace this ascending process of the mind toward absolute unity of consciousness, whereof even the most concentrated state of attention is but a faint image, we have no need of prob-

able hypotheses or of proceeding theoretically *a priori*. I find in "*El Castillo Interior*" of St. Theresa a description step by step of this progressive concentration of consciousness, which, starting from the ordinary state of diffusion, attains the state of attention, overpasses this little by little, and in some rare instances reaches perfect unity of intuition. The proofs I am about to give from St. Theresa are, it is true, restricted to one single case but one good observation is worth a hundred in different ones.* And this observation we may receive with full confidence. It is a confession made by command of the spiritual power, and it is the work of a very keen intellect and a very skillful observer, who knew well the use of words and used them with discrimination, for the expression of fine shades of meaning.

I beg the reader not to forget that here a Spanish woman of the 16th century analyzes her own mind in the language and in accordance with the ideas of her time: but what she says may be translated into the language of contemporary psychology. Such translation I attempt, with the purpose of showing this ever-advancing concentration, this progressive narrowing of the field of consciousness, described in accordance with a personal experience.

There is, says St. Theresa, a castle built out of one diamond of incomparable beauty and purity: to enter and to dwell therein is the aim of the mystic. This castle is within, in our souls; we do not have to go out of ourselves to come to it, yet the road is long and arduous. To reach it we must pass through seven stopping places: we come to it through seven degrees of "prayer." In the preparatory stage, one is still surrounded by a multiplicity of images, in the "life of the world"—which means that consciousness in this

* Probably others might be found by searching through the mystic literature of different countries. The passages here to be quoted are taken from "*The Interior Castle*," and a very few from the autobiography of St. Theresa.

* Carpenter, "Mental Physiology," Chapt. III.

stage takes the ordinary, the normal course.

The first stopping-place is reached through "vocal prayer." That is: Prayer uttered in a loud voice, articulate speech, produces the first degree of concentration, or brings the scattered consciousness into one tract.

The second stopping-place is that of "mental prayer," which means that the interiority of thought increases: inner speech takes the place of outer. Concentration becomes easier; the consciousness no longer requires the material support of articulated words, or of words heard, in order not to stray away.

The "prayer of abstraction"* is the third degree. Here, I confess, I find difficulty in translating. I fail to see in this anything but a higher form of the second stage, separated from it by a slight shade of difference such as can be appreciated only by the consciousness of the mystic.

So far, there is activity, movement, effort—all the faculties are still in play: but now one has "no longer to think much, but to love much." In other words, the consciousness is passing from the discursive to the intuitive form, from plurality to unity; it tends to be no longer a radiation around a fixed point, but one state of enormous intensity. And this transition is not the effect of a capricious, arbitrary will, nor of the mere movement of thought left to itself; it requires the impulsion of a strong love, the "coup de grâce," that is, the unconscious coöperation of the whole being.

The "prayer of quietude" brings one to the fourth stopping-place and then "the soul no longer produces, it receives;" this is a state of high contemplation not peculiar only to religious mystics—a truth appearing suddenly in its entirety and manifesting itself as such, without any of

the tedious processes of logical demonstration.

The fifth stopping-place, the "prayer of union, is the beginning of ecstasy; but it is instable. This is the "glimpse of the divine spouse," but without lasting possession. "The flowers only half-opened their calix, have given forth only their first perfume." The fixedness of consciousness, is not yet complete; it has oscillations and lapses; it cannot yet maintain itself for any time in this extraordinary and unnatural state.

At last it attains ecstasy in the seventh stopping-place through the "prayer of rapture." "The body grows cold, speech and respiration are suspended, the eyes close, the slightest movement requires the greatest effort. The senses and the faculties remain without. . . . Though usually one does not lose feeling [consciousness], *it has happened to me to be totally deprived of it; this has happened but seldom and has lasted but a short time. More frequently feeling continues, but one experiences an indefinable trouble, and though one cannot act externally, one does not cease to hear. It is as if it were a confused sound coming from afar. And even this manner of hearing ceases when the rapture is in its highest degree.*

What then is the seventh and last stopping-place, reached by the "flight of the spirit," what is there beyond ecstasy? Unification with God. This comes about "in a sudden and forceful way. . . . with such power that one would strive in vain to withstand this impetuous leap." God has now come down into the very being of the soul, which becomes one with him. Nor is this distinction between two states of ecstasy in my opinion without ground. In its highest degree, the abolition of consciousness is brought about by its excess of unity. This interpretation seems justified when we reflect upon the two passages which I have given in italics: "It has happened to me to be totally

* "Oraison de recueillement," in Spanish, probably, *recogimiento*—a state of abstraction, in which the mind secludes itself from the outside world.

-lator.

deprived of feeling" (consciousness); and "This manner of hearing ceases when the rapture is in its highest degree." Other passages to the same effect might be quoted from the same author. It is noteworthy that in one of her "great raptures" the Deity appeared to her without any form—as a perfectly undefined abstraction—at least she writes thus: "I will therefore say that the Deity is as a diamond of a transparence supremely limpid and much larger than the world.* In this I cannot but see a simple comparison and a literary metaphor. It is the expression of perfect unity in intuition.

This psychological description enables us to follow consciousness little by little up to its uttermost degree of concentration, to absolute monoidism; further, it affords us the answer to a question often raised and which has not been decided except on theoretical considerations: Can a state of uniform consciousness subsist? The testimony of some mystics would seem to justify an answer in the affirmative. True, it is a positive, commonplace truth that consciousness exists only through change. At least ever since Hobbes this has always been held: "Idem sentire semper et non sentire, ad idem recidunt:" but this law is infringed in certain exceptional individuals, but it still retains the discursive form: it differs from very strong attention only in degree. The great mystics alone have, attained absolute monoidism. All men everywhere and at all times have, unwittingly, considered perfect unity of consciousness—*εὐωδία*—as the supreme consummation of ecstasy rarely attained. Plotinus obtained this favor only four times in his life, according to Porphyrius, who himself obtained it but once, at the age of 66 years.* At this uttermost point consciousness cannot long persist: so they declare. But this instability which they account for in

their own way—by their unworthiness to enjoy such happiness, the impossibility of a finite being becoming infinite, etc.,—is in fact explained by psychological and physiological causes. In ecstasy the consciousness is placed outside of the necessary conditions of its existence, and the nervous elements which are the supports and the agents of this prodigious activity cannot keep it up very long. Then the mystic comes back to earth, becoming "the little donkey that goes his way browsing."

III. The weakening of attention is extreme in mania, which consists in a general and permanent super-excitation of the psychic life. The diffusion is not interior only; it expresses itself continually outwards and is ever expending itself. There is constant agitation, a continual need to speak, to shout, to act violently. The state of consciousness projects itself immediately outwards. "Maniacs" says Griesinger, "may now and then for a very long time keep up an expenditure of muscular force that a man in sound health would be incapable of. For weeks or for months they will go almost without sleep, and the only explanation of their vast expenditure of force would seem to be that in consequence of an anomaly of their muscular sensibility they have no feeling of fatigue." At the same time, sensations, images, ideas, feelings follow one another with such rapidity that they hardly reach the degree of complete consciousness; and often, for the looker-on the tie of association which binds them is not discoverable at all. Said one of them: "It is truly frightful to think of the extreme rapidity with which thoughts succeed one another in the mind." In short, in the mental order they present a disordered flow of images and ideas; in the motor order, a flow of words, cries, gestures, and impetuous movements.

We need not delay here to show that all the conditions that are opposite to the state of attention are found

* "Autobiography," p. 526.

† Porphyrius, "Life of Plotinus," Chap. XXII.

combined in mania. Neither concentration nor adaptation nor duration is possible. This is the triumph of cerebral automatism left to itself and freed from all control. So too there is sometimes in the subjects of mania an extreme exaltation of memory: they can recite long poems forgotten years before.

In this intellectual chaos, no state lasts for any time. "But let one act powerfully upon the mind of a maniac, or let an unexpected occurrence arrest his attention, and at once he becomes rational and reason holds its own so long as the impression retains sufficient power to fix his attention."* From this we learn again upon what causes spontaneous attention depends.

We class under the general title of *exhaustion* a pretty numerous group of states in which attention does not rise above a very low degree. Not because it has to struggle against an excessive automatism, as is the case in mania; its weakness comes from itself. We find instances among hysterical subjects, among melancholics, in the beginning of intoxication, at the onset of sleep, and in extreme fatigue, whether physical or mental. Children afflicted with chorea are also but little capable of attention.

These morbid or semi-morbid states confirm the thesis already laid down when we studied the normal state—that the mechanism of attention is essentially motor. In exhaustion there is impossibility or extreme difficulty of fixing the attention. The meaning of this, I repeat, is, that an intellectual state cannot predominate nor last, nor produce a sufficient adaptation. This cerebral exhaustion, which results from some fault of nutrition, manifests itself in two ways: first, by a state of consciousness without intensity and without duration; then, by an insufficiency of motor nerve influx. If the movements which, are said to "accompany" attention—those of respiration, cir-

culatation, of the head, the members, etc., are feeble; if all these motor phenomena are, as we maintain, not concomitants but elements, integral parts of attention which give to the intellectual state a delimitation, a support, a body, so to speak; if their effect, in the normal state, is to reinforce sensation, image, or idea; then clearly these conditions are here absent or deficient and there can be at most only feeble and unsustained attempts at attention; this is what actually occurs.

Take the case of intoxication—the simplest and commonest case of all, and which has this advantage, that here we can observe the disordering of the movements to the end. It is a familiar biological law that dissolution follows the reverse order of evolution—that is destructive work proceeds from the complex to the simple from the less to the more automatic. This is verified in intoxication. First to be affected are the more delicate movements, those of speech, which becomes embarrassed, of the fingers, which lose their precision; later, the semi-automatic movements which constitute walking—the body reels; still later, the drunken man cannot even retain the sitting posture, and falls to the floor; finally, there is loss of the reflex actions, and the man is dead drunk; beyond this point, there is loss of the respiratory movements. Dismissing the latter phases of the process, which are purely physiological, let us go back to the beginning and consider what takes place in the consciousness. The power of inhibition grows weak; one speaks without reserve: "in vino veritas." Then little by little the consciousness becomes clouded, wavering, indefinite. Thus, the weakening of attention and that of the movements go together: they are two aspects of a phenomenon that at bottom is one.

Yet another question arises, which we do not mean to treat here; we will simply point it out to the reader. If the state of nerve exhaustion pre-

* Esquirol, "Maladies Mentales," Vol. II., p. 47.

vents attention, that fact is an indication as to the source of that power. A man in sound health is capable of attention, effort, work in the widest sense; a man whose strength is reduced is incapable of attention, of effort, of work. But work done is not *e nihilo*; it cannot be anything else but a transformation of pre-existing energy, a change of reserve force into actual work. This reserve force, stored in the nerve substance, is itself the effect of chemic action going on therein. Such then is the ultimate condition of attention.*

According to the generally accepted theory, sleep, too, is the result of exhaustion, and of a sort of intoxication. The very few authors who have studied attention in sleep start from the hypothesis, implicitly or explicitly held, that it is a power, a faculty, and the question they raise is whether the faculty is suspended. The question for us is whether in dreaming this *state* of relative monoidism is produced.

It is certain that often a sensation, an image becomes predominant in the series of states of consciousness which in dreaming flits swiftly and in disorder through the mind. Then comes a moment of inhibition; we even are sensible of at least a partial, temporary adaptation; finally, the predominant state is always accompanied by some strong affection or emotion—fear, anger, love, curiosity, etc.—so that we find all the essential characters of spontaneous attention.

Are there also equivalents of voluntary, artificial attention? First of all we have to exclude an entire class of cases that one might be tempted to regard as affirmative instances,—as solutions of problems, scientific discoveries, artistic or mechanic inventions, ingenious combinations suggested in dreaming. Tartini, Condorcet, Voltaire, Franklin, Burdach, Coleridge, and many others have put on record personal observations, and these are so well known that I have

simply to refer to them. But all this is the result of cerebral automatism, i. e., of a sort of activity that is completely antagonistic to voluntary attention. One discovers, invents, solves problems only according to one's mental habitudes. Coleridge composes a poem, but does not work out problems in algebra; Tartini composes his Sonatas, but does not invent a financial scheme. In every case there is first a long period of brooding, sometimes conscious, usually unconscious—i. e., purely cerebral—which suddenly reaches its term, and the idea, invention, solution, is evolved. The mental state in dreaming is as unfavorable as it well can be to the constituting of voluntary attention; for on the one hand there is the rapidity and the incoherence of the associations, and on the other hand the disappearance or extreme impairment of coordination. The highest, most delicate, and most complex forms disappear first. Still the will power is not always suspended, for sometimes we strive to keep in a state that pleases us, or to quit a situation that is disagreeable. There are cases which present at least some of the elements of voluntary attention—as is quite natural in those who have acquired that habit. Sometimes the absurdity of a dream strikes us, and we proceed to note them for ourselves; for instance, we make calculations so palpably inexact that we set about discovering the sources of error.* But this is the exception. If sleep were not a suspension of effort in one of its most exacting forms, it would not be separative.

As regards natural somnambulism and still more as regards hypnotism, the question is still full of obscurity. Braid, who first freed artificial somnambulism from the atmosphere of the marvelous that surrounded it, reduced the whole psychology of this phenomenon to "concentration of attention," and the same view, with

* See further remarks upon this point in the concluding chapter, § 2.

* See instances in Sully, "Illusions," Chapt. vii. (Humboldt Library, Nos. 56, 57.)

some difference, has been held by Carpenter, Heidenhain, Schneider, and in particular by Beard. According to Beard, somnambulism is a functional disorder of the nervous system, in which the activity of the nervous system is concentrated in a limited region of the brain, the rest being inactive, so producing loss of volition. He used to compare the brain rind to a gas candelabrum with many jets, when these are all lighted, we have wakefulness; when they are turned down low, but not quite put out, we have sleep; when all are put out save one, and that burns full, using all the gas, we have hypnosis in its several degrees. This theory of "concentrated attention" has been criticised a good deal,* and it seems to be hardly applicable to all cases. Can the hypnotism produced in fowls and crayfishes by Father Kircher, Czermak, and Preyer, be attributed to abnormal concentration of attention? True, the hypnotized subject is well prepared for monoideism but is this state, artificially produced by suggestion, to be compared to attention properly so called? Is it not rather like the fixed idea?

IV. Idiocy is of many degrees ranging from entire nullity of intelligence to simple weak-mindedness, according to the point at which the arrest of development took place. Some imbeciles have even a special talent, as for mechanic arts, drawing, music, reckoning, all the more striking because all around it is vacuum. These isolated faculties have been likened to the instincts of animals.

The most elementary conditions of attention are wanting or appear only by flashes. The defective senses transmit only dull impressions. The higher centers are unfitted to elaborate these or to connect them. The state of the *motor* power, that essential factor of attention, calls for special notice. It always presents anomalies—paralysis, convulsions, contractures, epilepsy, or a narrow

automatism which keeps ever repeating the same movements, for instance, continually swaying the body in accompaniment of a monotonous sing-song, beating the walls, etc. There is no power of coördination or control. "Imbeciles, idiots," says Esquirol, "are without the faculty of attention, and this renders them incapable of education: this observation I have made again and again in studying them. Wishing to take plaster casts of a great number of persons affected by mental disease, I succeeded with the victims of mania, even wild maniacs, and with melancholics; but I never could get the imbeciles to keep the eyes shut long enough for the plaster to spread over them, however willing they might be to have the operation performed. I have even seen them cry because the cast could not be taken; and they would try again and again, but in vain to keep the pose given them: they could not keep the eyes shut for more than a minute or two."* The lowest grade of imbeciles do not even possess the spontaneous attention of animals for their own preservation. The less refractory cases afford some small opportunity for education. Séguin and others have by patient training obtained some results. Without inquiring whether the great efforts made to this end during the past 50 years are of any sociological value, and whether the labor might not have been more usefully bestowed, we see that the different systems of education all aim at establishing some few dominant, regulating states, that is, a sort of attention. The instructor begins with acts of great simplicity. Thus, in certain asylums in the United States, in order to awaken attention in idiots, they are taught to put pegs in holes, to repeat a tune, to associate words with certain figures, etc.†

*Esquirol, "Maladies Mentales," vol. I., p. 11.

†Séguin, "Traité de l'Éducation des Idiots," Paris, 1846; Ireland, "Mental Idiocy."

*See J. Stanley Hall, in "Mind," April, 1885; Gurney, *ibid.*, Oct., 1884.

To sum up, attention is an attitude of the mind—a *formal* state I should call it but for the misuse of the term. We might represent graphically the totality of its manifestations, whether normal or morbid, by a right line bifurcating at both extremities. In the middle stands mean spontaneous attention. Following our imaginary line to the right (in the direction of increasing intensity) we have strong spontaneous attention, then preoccupation, next the fixed idea in its weak state. The line now bifurcates, to represent the two extreme degrees—the fixed idea, and ecstasy. Again we go back to the starting-point, and follow the line to the left—in the direction of diminishing intensity. We have voluntary attention, first in the form of an organized habit, then in its mean form, next vacillating, lastly a bifurcation answering to the two extremes of temporary failure of attention on the one hand, and impossibility of attention on the other. Between the several forms are shades of difference here overlooked, but we thus see a community of origin and a oneness of composition, in all these states.

CHAPTER V.

CONCLUSION.

I. WE have endeavored to show that attention, in all its forms, has for its immediate and necessary condition interest, that is, affective states natural or artificial, and that its mechanism is motor. It is not a faculty, a special power, but an *intellectual state* that becomes dominant owing to certain complex causes which produce a longer or shorter adaptation. We have dwelt sufficiently upon the rôle of the movements, and to them we need not return; but it will be well to study for a moment those affective states which awaken or which sustain attention. So far we have simply

shown their function, and have said nothing of their nature.

It is not proposed to present to the reader, in passing, and as an episode, a psychology of feelings. I simply intend to show that inasmuch as attention always depends upon affective states, it necessarily implies motor elements. Thus will our principal thesis be justified once again and in another way.

First we must put away the generally accepted belief that the groundwork of the affective life consists in pleasure and pain. Pleasure and pain are but effects, results, tokens, signs, which show that certain appetites, inclinations, tendencies, are satisfied, or not satisfied. They represent only the superficial, ultimate form of the phenomenon—the only one that enters consciousness. They are the hands of the clock, not its works. The true causes of the affective life are to be found deeper—in the inmost nature of the organism. The feelings, emotions, passions have their primal source in the vegetative life. Whatever comes from the heart, the vessels, the digestive, respiratory, or sexual organs, in a word, from all the viscera, that constitutes the *prima materies* of sensibility, just as whatever comes from the external senses is *prima materies* of the intelligence. And just as, physiologically speaking, the vegetative life precedes the animal life, which is based upon it, so, psychologically speaking, the affective life precedes the intellectual life, which rests upon it. The states which we call wants, appetites, inclinations, tendencies, desires, are the direct, immediate results of the organization of each animal. They constitute the true groundwork of the affective life. We say with Spinoza: "Appetite is the very essence of man. . . . Desire is appetite with self-consciousness. . . . From this it follows that the basis of effort, will, appetite, desire is not the fact that one has judged that a thing is good; but on the contrary

we judge a thing to be good *because* we are inclined to it by effort, will, appetite, desire." Primarily, pleasure is not sought for its own sake, nor pain for its own sake shunned, for plainly one does not seek nor shun what one does not know. It is only the animal that is capable of experience, that is, of memory and of reflection, that can seek or shun for their own sake states agreeable or disagreeable already experienced. Hence those psychologists—and many they be—who define sensibility as "the faculty of experiencing pleasure and pain," and who consequently regard these two phenomena as the essential characters, do not go back to the true origin of the affective life. To define not by the effects but by the cause, we should have to say that sensibility is "the faculty of desiring, and *consequently* of experiencing, pleasure and pain."* Much rather are these wants, appetites, desires (for brevity sake we will henceforth call them simply tendencies) themselves effects of the organization: the immediate expression of its modes of being, whether permanent or transient.

It is needless to bring together here facts and arguments in order to show that pleasure and pain depend upon tendencies, which in turn depend upon the organism. A brief excursion into the pathology of the affective states will suffice. We shall see that agreeable and disagreeable vary precisely as the tendencies. Where the normal man, with normal inclinations shall find pleasure, there the abnormal man, with abnormal inclinations, will find pain and *vice versa*. Pleasure and pain follow tendency as the shadow follows the body.

Let us begin with the tendencies connected with the fundamental function—nutrition. Every one has heard of the "longings" of pregnancy. In consequence of very imperfect nutrition during the first months, there

come disorders of the digestive, circulatory, and, secretory systems, which are expressed by whimsical longings and perverted tastes. The woman will eat clay, straw, tobacco, tallow. The same tendencies are seen in hysterical, chlorotic, and neuropathic persons. The beginning of insanity is sometimes marked by similar dietary eccentricities—thus a person will show a disposition to eat spiders, toads, worms. Lower still we find "coprophagy" and "scatophagy." A patient had to be watched, to prevent him from swallowing the contents of a cuspidor in a hospital ward*. And there is a like perversion of the sense of smell. Some neuropathic subjects find the odor of roses disagreeable but have a liking for that of valerian or of asafetida.

Is there any need to treat at length of the deviations and perversions of the sexual instinct? Even after due allowance has been made for imitation and debauch, for that which comes from the head, (the imagination), rather than from the senses, there still remains a plentiful harvest. The same conclusion always forces itself upon us; Change the organism and you change the tendencies, you change the position of pleasure and pain; hence these are but indicative phenomena, signs betokening that the needs of the organism, of whatever kind, are satisfied or countered.

Should it appear that the inclinations just enumerated are of too strictly physiological a kind, I can cite the group of irresistible impulses—the insuperable desire to drink, to rob, to set fire, to kill, to suicide. So far as consciousness is concerned, these impulses are causeless and without any reasonable motive, since their true cause and the conditions of their genesis, lie below it, and consciousness knows only the result of this unconscious work. These irresistible wants are produced in widely dissimilar forms. Those which are most frivolous are

*I employ their terminology though I do not myself accept it.

*Campbell, in the "Journal of Mental Science," July, 1886.

as instructive for psychology as those which are most forceful. Thus, a very inoffensive form of insanity indeed is "onomatomania." The search for the name of some unknown person, seen sometime by chance in a newspaper, takes up the whole mind of a patient, depriving him of sleep, and worrying him continually. How many names do we all forget, and never bestow a thought on them! But the subject of "onomatomania" has no rest till he recalls a name. When he does recall it, he is happy. So, whenever any irresistible impulsion whatsoever—to theft, to murder, etc.—is carried out, there follows a feeling of satisfaction.

These morbid manifestations have been closely studied in our time. They are regarded as symptoms of one single cause—degenerescence. Hence we always find the self-same series of cause and effect: anomaly in the organism—anomaly in the tendencies that express it—anomaly in the position of pleasure and pain.

So much being agreed, namely, that the essence of affective life consists in tendencies, whether conscious or not (and here consciousness acts only a subordinate part), how shall we represent these tendencies? The only positive notion that we can have of them is formed by considering them as movements (or inhibitions of movements) whether actual or nascent. Thus they take their place among motor phenomena: in other words, a want, an inclination, a desire always imply a *motor innervation* is one degree or another.

The carnivore that has seized its prey and is rending it with tooth and claw, has attained its object and satisfied its tendencies by the aid of a considerable expenditure of motor power. Suppose it does not yet hold its victim, but sees it and is watching its chance to seize it, then its whole organism is in a high state of tension; the movements are not executed, but on the slightest impulsion they are set in action. But

suppose the animal is only prowling, seeking by sight and scent some prey that chance may offer: in that case there is a state of half-tension, and the motor innervation is far less strong, and but vaguely adapted. Finally, in a state still tension, the animal lies in its lair: the undefined image of prey, i. e. the memory of the animal's it has before captured, passes through its mind: the motor element has very little intensity, is but nascent, and is not expressed by any visible movement. Between these four degrees there is certainly a continuity, and throughout the whole series there is a motor element, differing between one and another only in quantity.

The illustration is coarsely drawn on purpose, in order to make the matter clear. We might quite as well have taken love, aversion or fear, starting with their more pronounced motor manifestations, then exhibiting in succession their less pronounced degrees, finally reducing them to their purely interior state, which is only a very faint motor innervation—a movement in the motor state.

Thus a tendency is associated always with a physiological phenomenon which gives it a physical basis. It is no longer a "state of the soul," a mysterious, transcendental character. Tendencies, inclinations, desires, these terms and their synonyms signify a movement, nascent or aborted accordingly as it is fitted to be evolved to its uttermost limit, or as it is destined to undergo an arrest of development. Whether the concomitant state of consciousness appears or disappears, whether the tendency is conscious or unconscious, motor innervation in any event is ever the fundamental element.

The conclusion we reach therefore is, that attention depends on affective states, affective states are reducible to tendencies, tendencies are at bottom movements (or arrest of movement) whether conscious or unconscious. Hence, attention, spontaneous

or voluntary, is from its beginning connected with motor conditions.

II. It now remains for us to consider briefly the general physical conditions of attention.

If we observe men as they are, taken in mass, not persons of trained and cultivated minds, as psychologists nearly always do, it will be readily seen that spontaneous, and above all voluntary attention are exceptional states. Eliminate first the routine of life—that vast mass of habits which make us act like automatons, with vague and intermittent states of consciousness. Eliminate those periods of our mental life in which we are passive, because the order and succession of our states of consciousness come to us from without and the series of states is imposed upon us—as in reading a book of average interest, or in performing some manual or other work presupposing a succession of acts in a set order. Eliminate that state of relative mental repose wherein one is “thinking of nothing,” that is wherein the states of consciousness have neither intensity nor clear definition—as reverie in all its degrees. Eliminate states of passion and strong agitation with their irregular fluctuations and their diffusion of movements. These and perhaps a few other states being eliminated, what remains may be credited to the general account of attention. And in this general account the cases of spontaneous attention constitute the great majority of the entries while the clean and indisputable cases of voluntary attention are few—with many men and women, indeed, they hardly amount to anything. We have tried to give the psychological reasons of this. But we have also noted incidentally the familiar fact that in a state of fatigue, exhaustion, attention is very difficult, often impossible, never lasting. The reason is, that attention demands a larger expenditure of physical force than any other intellectual state, and that under special conditions.

Be it remarked once again that attention cannot exist save by a narrowing of the field of consciousness—which is the same as to say that *physically* it presupposes the calling into action a limited portion of the brain. It matters not whether we regard this portion as a localized region, or—a more probable supposition—whether we consider it to be formed of various elements diffused through the mass of the encephalon and working in concert, to the exclusion of others. The normal state of consciousness implies diffusion with distribution of working throughout the brain: attention implies concentration, with localization of the work of the brain, when the brain passes from the normal state to the state of strong attention, we have the analogue of what takes place when, instead of bearing a weight upon our shoulders we sustain it with one finger. This labor all imposed upon a part of the brain can be performed only by rapid transformation of potential energy or reserve energy into actual. All physiological work results from chemic action in the organism, and this chemic action has its rise in the food and the oxygen that enter the system. This production of work, resulting from nutrition, is by no means constant. Among those of feeble constitution the reserve work must needs be lacking, and hence exhaustion quickly supervenes. Even in persons of the most vigorous constitution, the accumulated capital is quickly spent, if the attention is strong and long continued. Hence it would seem that the last physical condition required by attention consists in what physiologists call “*dynamogeny*,” which is defined by Brown Séquard as “the power possessed by certain portions of the nervous system suddenly to call forth an increase of activity by a purely dynamic influence.” Dr. Brown-Séquard reports the case of a young girl who, every Sunday at the ringing of the church bells, fell into an ecstasy and stood for twelve hours on the sloping edge

of her bed, supported only by the toes and a very small part of the soles of the feet. Three strong electromagnetic shocks were powerless to affect her state immobility. The remainder of the week she remained in bed, exhausted and almost unable to stir. To perform this *tour de force* during half a day continuously, she had to develop an enormous power of action in the motor apparatus. It is not probable that cases of extraordinary and protracted attention presuppose in certain portions of the nervous system a like super-activity, and that this too is followed by a period of fatigue and powerlessness? But dynamogeny is a physiological state the causes of which are so little known, that it were useless to draw psychological deductions from it.

It is to be noted that the forgoing remarks apply strictly only to the *physical* conditions of attention. The terms *work*, and *transformation of energy* have a value and meaning only in the order of physical phenomena: the state of consciousness,

the interior happening (whatever idea we may form of it) is incommensurable with these. The "psychic force" spoken of by certain authors, is only a metaphor, unless by it you mean the physical conditions of a state of consciousness and these only. Hence to maintain that strong attention depends upon the possibility of a transformation of potential energy into actual, is simply to point out one of its fundamental material conditions, and nothing more.

Many practical consequences might be pointed out in concluding this study of attention. I will not attempt that task. My one object was to analyze the mechanism of attention—a subject which I had nowhere seen treated in such a way as its importance seemed to demand. This I have endeavored to do in accordance with the theory of evolution, showing that voluntary attention is but a higher, extreme form, resulting from lower forms by processes half-unconscious, half-conscious.

THE END.

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